



# **JOURNAL OF THE CARIBBEAN COLLEGE OF SURGEONS**

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# JOURNAL OF THE CARIBBEAN COLLEGE OF SURGEONS

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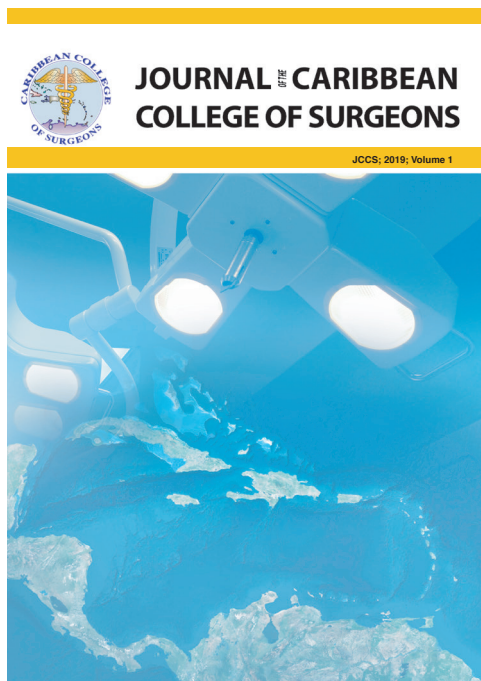
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## COVER DESIGN



**T**he cover design for the **Journal of the Caribbean College of Surgeons** depicts a satellite image of the Caribbean region taken from space. The image shows the tranquil beauty of the region on the background of the aqua blue Caribbean Sea.

Although, the Caribbean is relatively small, it casts a large footprint that can be seen far and wide.

The cover also shows the surgical main and satellite lights that we use on a daily basis to illuminate the work that surgeons do. The emblem of the Caribbean College of Surgeons is featured in the top left hand corner, bringing together the qualities of the Caribbean and the work of the surgeons.

**The cover was designed by our President, Dr. Cameron Wilkinson, and medical students from the Windsor Medical School, Omair Janjua and Shruti Patel.**





## PRESIDENT'S MESSAGE

### Continued Progress in the Journal of the Caribbean College of Surgeons

**Dr. Cameron Wilkinson, FACS, FCCOS**  
President of the Caribbean College of Surgeons  
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*Dear Colleagues,*

*The contribution of surgical research to advancements in the field of surgery cannot be underestimated. It has been the driving force over the last few centuries in the development of new techniques and it must also be acknowledged that the approach to surgical care, that once was considered standard, is also changing for the better.*

*A decision for surgeons in busy practices to carve out time for research in their field requires a great deal of commitment and dedication. Not every surgeon is able to do so. Therefore, those who do find the time to immerse themselves in such a noble activity should be applauded.*

*One of the objectives of the Caribbean College of Surgeons is to “stimulate the advancement of the practice of surgery through appropriate enquiry and research.” Over the years we have seen a significant increase in the number and quality of the manuscripts submitted, documenting the work and research of surgeons across the Caribbean. This is testament to the fact that the college is fulfilling one of its main objectives in the advancement of surgical research. This year we received a record number of submissions. I want to take the time to thank each member who contributed and to encourage you to continue your good work as it allows surgeons in the Caribbean to continue to refine our skills and stay on the cutting edge of surgery and technology.*

*I am also very pleased that this year based on the number and quality of the submissions, we were able to publish the second issue of the Journal of the Caribbean College of Surgeons. The authors should be indeed proud, as your work will be distributed and read across the globe in print and electronic format on our website.*

*I again say thanks to the Chairman of the Editorial Board and Vice President of the Caribbean College of Surgeons, Professor Shamir Cawich, and his committee for spearheading this effort to publish the work of the College. Your contribution is invaluable and the mark you are making in our institution is indelible.*

*I look forward to the exchange of knowledge in the second issue of the Journal of the Caribbean College of Surgeons.*

*Best regards to all.*

**Cameron Wilkinson**  
President, Caribbean College of Surgeons

## EDITORS NOTE

### Fulfilling the Mandate of the Caribbean College of Surgeons

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One of the mandates of the Caribbean College of Surgeons is to provide opportunities through which surgical experiences and scientific research can be shared between practitioners across the Caribbean. With this in mind, the College embarked on its own scientific publication - the Journal of the Caribbean College of Surgeons (J.C.C.S.).

Since the inaugural issue of the J.C.C.S. was published in the year 2018, we have seen an increase in the volume of submissions to the journal. Authors from across the region have contributed to this issue, demonstrating that the Caribbean remains a rich source of knowledge, expertise and data. We hope that the J.C.C.S. can be the forum to share these data to make a true and meaningful impact in surgical practice for the Caribbean.

The publication committee has worked tirelessly to make the J.C.C.S. a reality. On behalf of the College, I extend our gratitude to the members of the publication committee: Dr. Cameron Wilkinson, Prof Vijay Naraynsingh, Dr. Ramesh Jonnalagadda and Dr. Wesley Francis. We are also grateful to the guidance and tireless input from Prof. Sir Errol Walrond who been a valuable resource.

We take this opportunity to thank our contributors who have spent many hours preparing their manuscripts for publication. The contribution from our peer reviewers must also be recognized. They have given their unwavering support, invaluable time and expertise to this venture. Their collective efforts have contributed to advancing knowledge as a step to growth in surgical practice for the Caribbean.



## CORRESPONDENCE

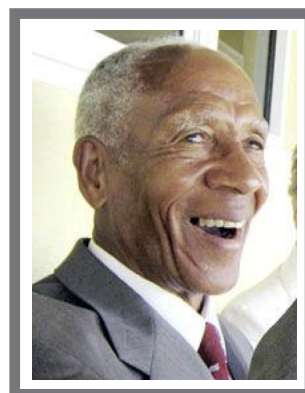
### Sir Cecil Cyrus A CARIBBEAN LEGEND

**Dr. Cameron Wilkinson, FACS, FCCOS**

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Dear Editor,

On behalf of the Caribbean College of Surgeons, I would like to congratulate Cecil Cyrus on being enlisted as Knight Commander of the Most Distinguished Order of Saint Michael and Saint George in the Queen's New years Honors List.

Sir Cecil Cyrus was born on January 6, 1929 in St. Vincent. He was motivated by the lack of equitable healthcare to pursue a career in medicine. After school in St Vincent he was accepted to pursue a degree in Medicine at the Queen's University in Belfast. He chose to become a surgeon and subsequently gained dual Fellowships of the Royal College of Surgeons of England and Ireland. He returned home to St. Vincent in 1963 and was appointed Consultant Surgeon at the Kingstown Hospital.

As the only trained surgeon on the island, Sir Cyrus realized that he was required to handle every health care problem on island, across all specialties. Therefore, he returned to University and obtained diplomas in ophthalmology and in obstetrics. During his amazing career, Sir Cyrus tirelessly documented the pathology he encountered and published the book "A Clinical and Pathological Atlas: The Records of a Surgeon in St. Vincent in the West Indies." For this, he was awarded a Master of Surgery Degree from Queen's University in Belfast.

Sir Cyrus also maintained a collection of photographs, specimens, radiographs and unique instruments and he converted this collection into a museum after his retirement in 2001. He tirelessly contributed to the development of surgery in the Caribbean by delivering numerous lectures and publishing over 40 scientific papers.

For his contributions, Sir Cyrus has received numerous other awards including: Order of the British Empire (OBE), Companion of the Most Excellent Order of St Michael and Saint George (CMG) and recognition by the Pan American Health Organization. Sir Cyrus also served as Deputy Governor General of St. Vincent and the Grenadines.

Sir Cecil Cyrus is a Foundation Member and Honorary Fellow of the Caribbean College of Surgeons. This new award as Knight Commander recognizes his outstanding achievements and his immense contribution to surgery in St. Vincent and the Caribbean region. We are proud of his many achievements and congratulate him on his recent Knighthood.

## ORIGINAL RESEARCH CONTRIBUTION

### Adherence to Guidelines of Surgical Antibiotic Prophylaxis: A Retrospective Cohort Study at a Referral Hospital in Guyana

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## ABSTRACT

**BACKGROUND:** Surgical Site Infections are a common, but preventable, post-operative complication that can increase mortality, morbidity and overall healthcare costs. In Guyana, there is no published data on antibiotic use to prevent surgical site infections. The objective of this study was to assess whether the surgical antibiotic prophylaxis practices at the Georgetown Public Hospital Corporation in Guyana are in adherence to the published guidelines from the American Society of Health-System Pharmacists.

**METHODS:** A retrospective cohort study was carried out to evaluate surgical antibiotic prophylaxis practices for clean and clean-contaminated operations in the general surgery, obstetrics & gynaecology and orthopaedic departments. Patients' charts were reviewed and the following data collected: indication for prophylaxis, agent selected, dose, time of administration, repeat dosing and duration of antibiotic. Each parameter was assessed for adherence to the guidelines. The data was analysed using SPSS version 23 applying descriptive methods.

**RESULTS:** Overall compliance with the guidelines for all six studied parameters was very low (1.6%). However, 75.0% of cases had appropriate indication while 23.8% had appropriate antibiotic selection and 1.6% received the appropriate dose. All cases were adherent to recommended re-dosing guidelines (although no case required re-dosing) and 82.6% were adherent to treatment duration. The adherence to the guidelines was significantly different across the departments ( $p < 0.05$ ), with obstetrics and gynaecology having better compliance. There was low compliance in the documentation (4.2%) of timing of first dose.

**CONCLUSIONS:** The current surgical practice in this environment is limited by a high rate of broad-spectrum antibiotic use, incorrect dosage for surgical antibiotic prophylaxis and inadequate documentation. We recommend targeted training so that healthcare providers may adopt guidelines for surgical antibiotic prophylaxis.

**BACKGROUND:** Surgical site infections (SSIs) include incisional, tissue and organ space infections that occur within 30 days of an operative intervention, if no implant is left in place<sup>1</sup>. Mortality rates are 2–3 times higher in patients in whom a SSI develops as compared to un-infected patients<sup>2</sup>. Surgical site infection prevention is based on the combination of preoperative preparation, perioperative surgical antibiotic prophylaxis (SAP), meticulous surgical technique and postoperative wound care.

Prophylactic use of antibiotics can reduce the incidence of SSIs<sup>3</sup>. The efficacy of SAP in reducing SSIs has been proven by many clinical trials<sup>5,6,7,8,9,10,12</sup>. The basic principle is to achieve adequate serum and tissue drug concentrations for the duration of the procedure. Bratzler et al<sup>1</sup> found that 92.6% of patients received SAP in accordance with published guidelines. However, van Kesserer et al<sup>13</sup> found that although adherence to separate aspects of SAP is favourable, overall adherence to all parameters is hard to achieve. Umscheid et al<sup>11</sup> found that while 100% SSI prevention may not be attainable with the current evidence-based prevention strategies, they could significantly reduce the burden of SSIs. This is in keeping with the findings of the International Nosocomial Infection Control Consortium (INICC)<sup>14,15,16</sup> that has shown that SSIs can be reduced significantly through the implementation of an effective surveillance approach. However, Shadi et al<sup>17</sup> showed that while surgeons had a good attitude towards SAP guidelines, their knowledge and practices were in keeping with accepted guidelines only 71.4% and 40% of the time respectively.



There are no published reports of SAP practices at the main tertiary referral hospital in Guyana, the Georgetown Public Hospital Corporation (GPHC). The 2013 edition of the GPHC Infection Prevention and Control Manual states: "Administer SAP only when indicated and select it based on its efficacy against the most common pathogens causing SSIs for a specific operation and published recommendation." However, it makes no recommendation on specific agents, leaving the selection to the clinician's judgment.

On the other hand, the 2013 Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery published by the American Society of Health-System Pharmacists (ASHP) details every aspect of SAP, while still allowing for clinical judgment. This study aims to assess whether the SAP practices at GPHC are in adherence to the ASHP guidelines.

**METHODS:** After gaining approval from the local institutional review board, a retrospective cohort study was carried out to evaluate SAP practices for clean and clean-contaminated operations in the general surgery, obstetrics & gynaecology and orthopaedic departments at the GPHC from June 1, 2017 to July 31, 2017.

We included all patients above the age of 18 years who underwent clean or clean-contaminated operations, as defined by the CDC wound classification guidelines. We excluded patients who had operations categorized by the CDC classification as contaminated or dirty operations. Patients who received therapeutic antibiotics before surgery were also excluded. Additionally, those with signs and symptoms of infection after surgery were excluded from this study in order to avoid difficulties in distinguishing prolonged prophylaxis from postoperative infection treatment.

The hospital registers for each department were searched to identify all patients who underwent any operation during the study period. All patient records were retrieved and data were retrospectively extracted from the patients' admission to 24 hours post-operation. The following data were extracted: indication for prophylaxis, agent selected, dose, time of administration, repeat dosing and duration of antibiotic.

We evaluated compliance to 6 specific aspects of the published ASHP guidelines<sup>4</sup>:

**Appropriate Use of SAP:** For this study, the definition of appropriate use was taken from the ASHP guidelines<sup>4</sup> that states: "SAP should be used in surgical procedures associated with a high rate of infection (i.e. clean-contaminated or contaminated procedures) and in certain clean procedures where there are severe consequences of infection (e.g. prosthetic implants), even if infection is unlikely. Inappropriate use would be the use of antimicrobial agents for dirty procedures or established infections because these cases are classified as treatment of presumed infection, not prophylaxis." An investigator evaluated all operative procedures to determine whether the use of SAP was appropriate.

**Time of First Dose:** The ASHP guidelines recommend that the first dose of the selected agent should be administered within 60 minutes of the incision<sup>4</sup>. We defined the "time of first dose" as the interval of time measured in minutes between the documented time of the antibiotic administration and the incision time.

**Duration of Antibiotics:** The ASHP guidelines recommend that the antibiotic administration should be discontinued within 24 hours after the end of the operation<sup>4</sup>. Therefore, the "duration of antibiotics" was defined as the interval in hours between the last dose of antibiotics and the termination of the operation.

**Antibiotic Selection:** The ASHP guidelines recommend that the agent selected should be inexpensive, non-toxic and limited-spectrum in microbial coverage<sup>4</sup>. We documented the antibiotic selected and whether it was limited or broad-spectrum in microbial coverage.

**Antibiotic Dosage:** The ASHP guidelines recommend that the dosage of the antibiotic should be sufficient to maintain serum and tissue drug concentrations for the duration of the operation<sup>4</sup>. Intravenous cefazolin was recommended for most of the procedures. We documented the agent selected and the dosage administered in each case.

**Antibiotic Re-Dosing:** The ASHP guidelines recommend that a repeat dose of the antibiotic should be administered if the duration of the procedure exceeds two half-lives of the drug or if there is excessive blood loss during the procedure<sup>4</sup>. Therefore, the administration of a repeat dose was documented. In any case that re-dosing was identified, the duration of the operation and the estimated blood loss were documented to determine compliance.

The data were analysed using the Statistical Package for Social Sciences version 23. Descriptive analyses were used to evaluate performance and demonstrate the characteristics of the study sample.

**RESULTS:** There were 1,234 operations performed at the GPHC during the study period. Of this, 504 cases met the study inclusion criteria. There were 91 cases in the orthopaedic department, 213 cases in the obstetrics & gynaecology department and 200 cases in the general surgery department.

There were 167 (33.1%) clean cases and 337 (66.9%) clean-contaminated cases. Table 1 describes the pattern of antibiotic use and types of operations included in the study.

Table 1: Surgical Operations and pattern of SAP use at the GPHC			
Name of Operation	Number (n=504)	Type of Operation	Antibiotic Administration
Obstetrics & Gynaecology Operations	213		
• Bilateral tubal ligation	25	Clean	Yes
• Cesarean section	125	Clean-contaminated	Yes
• Total abdominal hysterectomy	26	Clean-contaminated	Yes
• Other	37	Clean/clean-contaminated	Yes
General Surgery Operations	200		
• Hernia repair	43	Clean	Yes
• Hydrocelectomy	41	Clean	No
• Exploratory laparotomy	31	Clean/clean contaminated	Yes
• Other	85	Clean/clean-contaminated	Yes
Orthopaedic Operations	91		
• Joint replacement	5	Clean	Yes
• Fixation with implant	73	Clean	Yes
• Other	3	Clean	Yes

Table 2 outlines the antibiotic agent selected and the dosage administered. The commonest agent used for SAP was 1 gram of ceftriaxone in 247 (49%) cases. The second most common agent was 1 gram of cefazolin that was used in 79 (15.7%) cases. The recommended SAP agent was 2 grams of cefazolin and this was used in only 12 (2.4%) cases.

Table 2: Antibiotic Agent and Dosage			
Antibiotic Agent	Dosage	Number of Cases	Percentage
None	0	71	14.1%
Ceftriaxone	1g	247	49.0%
Ceftriaxone	2g	1	0.2%
Cefazolin	1g	79	15.7%
Cefazolin	2g	12	2.4%
Cefuroxime	1.5g	6	1.2%
Amoxicillin/Clavulanate	1.2g	23	4.6%
Other	---	65	12.9%
Total	---	504	100%

When antibiotic prophylaxis was indicated according to the ASHP guidelines, SAP was appropriately administered in 75% of cases. However, antibiotics were administered after operation in 17.5% of cases. The orthopaedic department was responsible for most of the deviations in this aspect of the guidelines.

When SAP was used, the selected agent was in compliance with ASHP guidelines in 23.8% of cases. However, when the appropriate agent was selected, only 81 (11.1%) patients were administered the recommended dosage of antibiotic.

There was inadequate documentation of the time that the first dose was administered in 66.9% of cases. In the 29 cases where the documentation was appropriate, the antibiotic was administered within 60 minutes of the incision in 21 (72.4%) cases. However, there was insufficient information to evaluate the compliance across the departments studied.

The duration of the operations ranged from 12 to 186 minutes and excessive bleeding was not documented in any case. Therefore, repeat dosing would not have been indicated according to ASHP guidelines.

When we evaluated compliance to SAP use by department, we found that the obstetrics and gynaecology department was most compliant with the guidelines. There was significantly lower compliance ( $P < 0.05$ ) from general surgery and orthopaedic departments, and there was no statistical difference between these two departments in terms of compliance.



<b>Table 3: Adherence to Studied Aspects of Published ASHP Guidelines <sup>4</sup> in 504 Persons</b>					
	Appropriate Use of SAP n (%)	Appropriate Agent Used n (%)	Appropriate Dose Given n (%)	Appropriate Repeat dose n (%)	Appropriate Duration n (%)
General Surgery	133 (26.3%)	36 (07.1%)	38 (7.5%)	200 (39.7%)	185 (36.7%)
Obstetrics & Gynaecology	187 (37.2%)	81 (16.1%)	57 (11.3%)	213 (42.2%)	209 (41.5%)
Orthopedics	58 (11.5%)	3 (00.6%)	7 (1.4%)	91 (18.1%)	22 (04.4%)
Total	378 (75.0%)	120 (23.8%)	102 (20.2%)	504 (100%)	416 (82.5%)

**DISCUSSION:** In this setting all departments used SAP, which reflects the awareness among health-care professionals of the potential for SAP to prevent SSIs. The surgical teams were compliant with all parameters of the published ASHP guidelines in only 8 (1.6%) cases. The poor compliance may be due to the absence of specific institutional recommendations and/or policy enforcement. Alternatively, it may be a reflection of lack of availability of appropriate agents in this hospital setting or simply poor documentation by the health care team. However, it is outside the scope of this study to determine which factors are responsible for the practice deviations observed within this study.

The poor compliance rates are not limited to this hospital. In fact, many other centres across the globe share similar low compliance rates. A Jordanian study found that none of the observed cardiac operations was adherent to all SAP guidelines, with wide variation in adherence to individual parameters<sup>10</sup>. Even in the USA, a study of Medicare patients undergoing varied surgical procedures demonstrated that only 55.7% of patients received the SAP first dose one hour before the incision and only 40.7% of patients had SAP discontinued <24 hours after surgery<sup>[2]</sup>.

For most types of operations in orthopedics, general surgery and obstetrics & gynaecology, a single pre-operative dose of a first generation cephalosporin is recommended. Cefazolin is a good choice because it has a relatively long duration of action, is effective against the most commonly encountered organisms in surgical procedures and has a relatively low cost<sup>[4]</sup>. Further post-operative doses are not needed and the antibiotic should be discontinued within 24 hours post operation. We believe that due to the lack of institutional protocols and/or enforcement in our setting, individual physician practices vary. This may explain the tendency for the use of broad spectrum or combination antibiotics and the continued use of SAP beyond 24 hours in our study.

A third-generation cephalosporin (ceftriaxone) was used for the majority of cases (48.9%) in our setting. This is a similar finding to a study carried out in Jordanian hospitals, where ceftriaxone was most commonly used in the surveyed departments, followed by cefuroxime (second-generation cephalosporin) and cephalexin (first generation cephalosporin) in limited cases<sup>10</sup>. In another study performed in Eastern France, 95.7% received a broad-spectrum antibiotic regimen. The excessive use of broad-spectrum antibiotics for prophylaxis is not recommended because it increases the risk for resistance, causes more adverse events, and increases health-care costs<sup>19-21</sup>. Cefazolin was used for SAP in 18% of cases in our setting. This may have been the agent that was available at the institution, but further studies are needed to ascertain the reason for this pattern of antibiotic selection.

Optimal timing of antibiotic administration is considered an important factor for effective prophylaxis<sup>19</sup>. Inappropriate timing may result in low plasma concentrations of the antimicrobial agent at the time of incision or throughout the procedure. The poor documentation of first dose timing in our study did not allow for detailed analysis. However, in the few cases that were properly documented, SAP was administered within one hour of the incision in 72% of cases – compliant with ASHP guidelines.

According to ASHP guidelines, the minimum duration for antibiotic coverage is from the time an incision is made until the time it is closed, which is usually covered by a single dose. There was high adherence (82%) to single dose antibiotic use and this was compliant with the ASHP guidelines since the duration of operations ranges from 0.2-3.1 hours and there was no case with excessive bleeding.

The recommended re-dosing interval in an adult with normal renal function is once the procedure has been in progress beyond two half-lives of the agent selected. The half-life of Cefazolin is 1.2-2.2 hours and 5.4-10.9 hours for Ceftriaxone. It was alarming that antibiotics were restarted post-operatively for 60% (n=91) of orthopedics cases. An Indian study reported that antibiotics were administered for as long as 14 days and only 1-8% of surgeons who prescribed antibiotics in surgical procedures stopped prophylaxis after 24 hours<sup>22</sup>. Extended prophylaxis has shown to be of no benefit and is potentially harmful due to the development of drug toxicity, super-infections and bacterial resistance<sup>21,22,23,24</sup>. The general surgery department in this study showed the least adherence in selection of antibiotic compared with the other two departments, a finding that differs from a Turkish study<sup>20</sup> that showed that general surgeons use antibiotic prophylaxis more appropriately.

**CONCLUSION:** Surgeons are aware of the need for SAP. However, there is a high rate of broad-spectrum antibiotic use and that is not adherent to ASHP guidelines. Further efforts are needed to ensure implementation of the accepted guidelines and appropriate documentation. This may be achieved through regular educational sessions targeting surgeons and periodic assessment of compliance with evidence-based guidelines.

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## ORIGINAL RESEARCH CONTRIBUTION

### Laparoscopic Management of a Large Hiatal Hernia

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## ABSTRACT

**BACKGROUND:** *Herniation of a portion of abdominal contents through the oesophageal hiatus into the thorax, is the broad definition given for hiatal hernias<sup>1</sup>. There are four different types of hiatal hernias. The sliding hernia (Type I) occurs when there is circumferential weakness of the phreno-esophageal ligament, allowing a portion of the cardia of the stomach to herniate cranially<sup>2</sup>. Types II, III and IV are referred to as para-esophageal hernias.*

**REPORT OF A CASE:** *We present a case in which laparoscopic repair was completed for a symptomatic giant hiatal hernia.*

**CONCLUSION:** *Hiatal hernia repair is another procedure that evolved from open to laparoscopic repair, which is now the preferred approach to management. This shift has been supported by several studies demonstrating that laparoscopic repair has similar recurrence rates to open repair, with improved morbidity, shorter hospital stay and reduced analgesia requirements.*

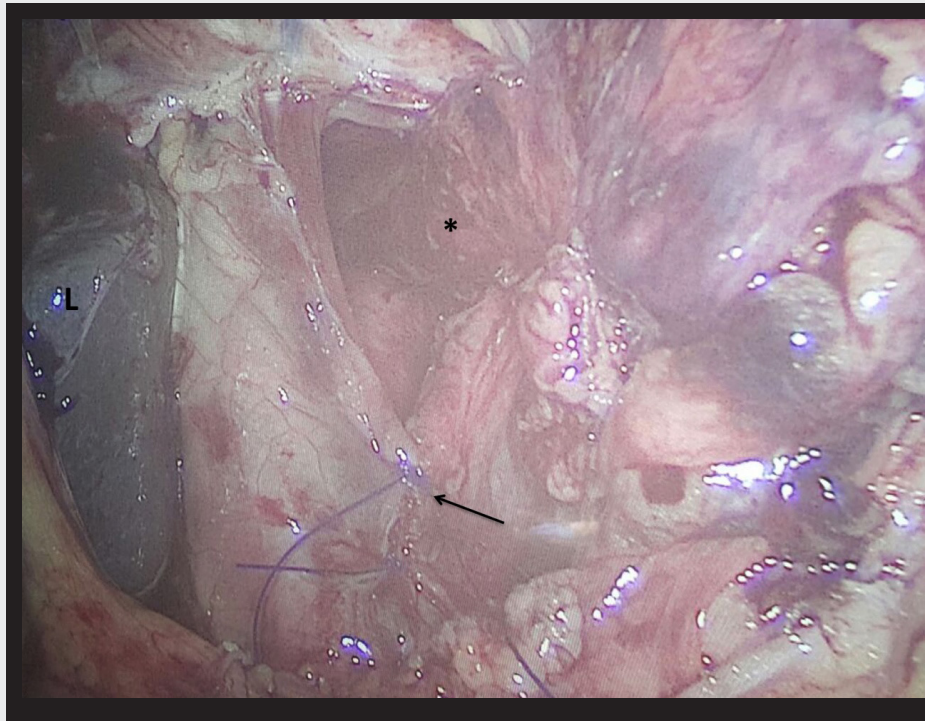
**BACKGROUND:** There are four different types of hiatal hernias; Type I, II, III and IV. The sliding hernia (Type I) occurs when there is circumferential weakness of the phreno-esophageal ligament, allowing a portion of the cardia of the stomach to herniate cranially<sup>2</sup>. Types II, III and IV are referred to as para-esophageal hernias.

In the elderly population, 5-10 % of hiatal hernias are para-esophageal hernias, with 90% of these being type II<sup>3</sup>. One of the likely causes in the elderly is the progressive weakening and stretching of the phreno-esophageal membrane, resulting in a widened diaphragmatic opening.

**REPORT OF A CASE:** A 72-year-old woman was referred with a five-year history of persistent dyspepsia associated with epigastric and retrosternal pain. She was known to have gastro-esophageal reflux disease and celiac disease, for which she was being treated with a high dose proton pump inhibitor, domperidone and gluten-free diet. The patient's medical history was only noteworthy for osteoarthritis controlled on paracetamol and an open hysterectomy performed 30 years prior. She claimed compliance to her medications and dietary restrictions; despite this however, the retrosternal pain continued.

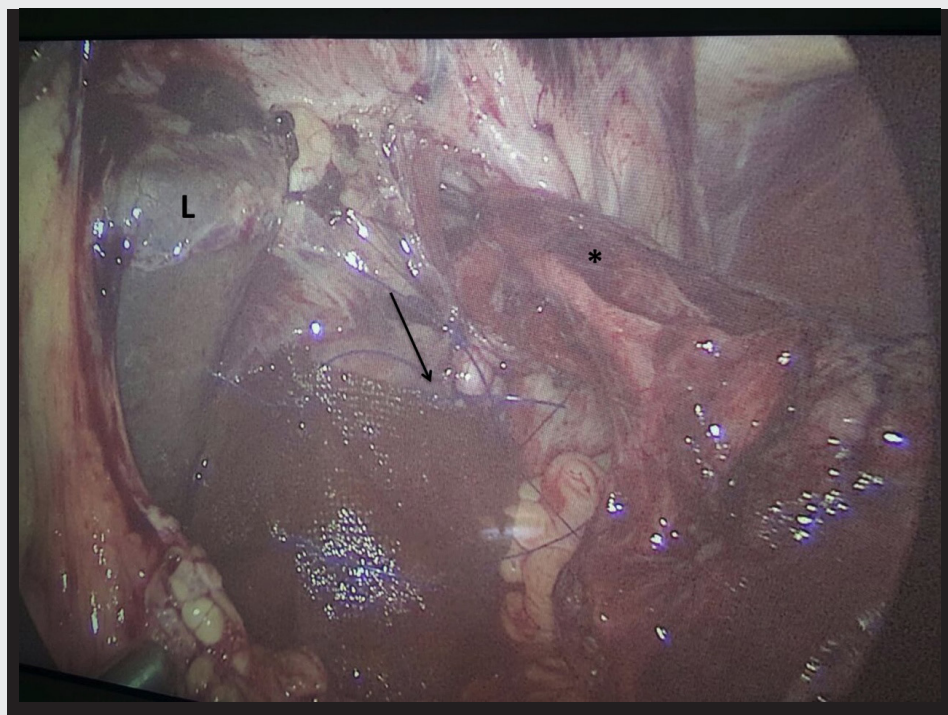
A barium meal showed the presence of a large hiatal hernia. An upper gastrointestinal endoscopy performed revealed an inlet patch of gastric mucosa in the distal oesophagus and confirmed helicobacter pylori gastritis. Despite medical treatment for helicobacter pylori, her symptoms did not resolve. A computerized tomographic (CT) scan of the chest and abdomen demonstrated a type III hiatal hernia with at least 80% of the stomach comprising the contents of the hernia sac. The patient was counseled on surgical management and she was consented for laparoscopic repair of the hiatal hernia with fundoplication.

A five-port technique was used after a pneumoperitoneum was established using the Veress needle technique. A large hiatal hernia was confirmed and at least 80% of the stomach was found within the thorax. The stomach and the hernia sac were reduced into their correct anatomical location, after which a 5cm hiatal defect remained. The partially closed defect is demonstrated in figure 1.



**Figure 1:** Laparoscopic view of the operative field demonstrating the left liver (L) and sutures partially closing the oesophageal hiatus (arrow)

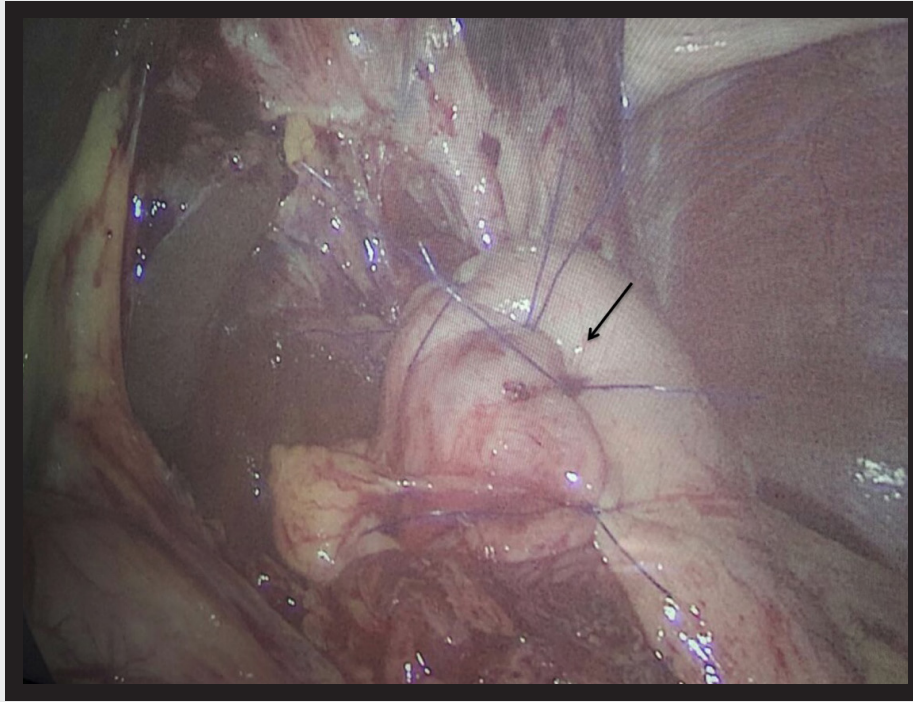
A posterior cruroplasty was performed, excess hernia sac was excised and the repair was reinforced with composite mesh (figure 2). The short gastric vessels were not divided and there was no need for an oesophageal lengthening procedure. A Nissen's fundoplication was subsequently performed as the anti-reflux procedure (figure 3).



**Figure 2:** Laparoscopic view of the operative field. The left liver (L) is seen in the image. The oesophagus (asterix) has been retracted to reveal a mesh (arrow) reinforcing the sutured cruroplasty.

The patient was discharged on day one post operation, tolerating liquids. She is currently being followed as an outpatient and has not had recurrent symptoms up to one year after her operation.





**Figure 3:** Laparoscopic view of the completed Nissen fundoplication (arrow).

**DISCUSSION:** Four types of hiatal hernias are described in the literature classified from I to IV <sup>4</sup>. Type I, occurs when the gastro-esophageal junction migrates proximally from its normal position into the posterior mediastinum with the stomach remaining in its normal longitudinal orientation. The majority of hiatal hernias are type 1, with an incidence rate greater than 95% <sup>5</sup>.

Types II to IV are grouped together as para-esophageal hernias, and more than 90% of these are type III hernias <sup>5</sup>. Type II hernias are also referred to as pure para-esophageal hernias because the gastro-esophageal junction remains in its normal position, while a portion of the fundus of the stomach herniates into the mediastinum. Type III is a combination of types I and II. These hernias are also known as mixed type and occur when both the gastro-esophageal junction and the gastric fundus herniate into the chest. Type IV hernias are characterized by the presence of structures other than the stomach within the hernia sac, such as omentum, colon or small bowel.

The patient in this case, presented with a symptomatic type III para-esophageal hernia. The options for repair included a trans-thoracic or trans-abdominal approach, using open, laparoscopic or thoracoscopic techniques. The principles of repair must be adhered to regardless of the approach or technique used: tension-free reduction of the contents into the abdomen, excision of the sac and narrowing of the oesophageal hiatus <sup>6</sup>.

The transthoracic approach is performed through the left chest to gain access to the oesophageal hiatus. Although surgeons utilizing this approach argue that they are better able to dissect the hernia sac, there are no randomized-controlled trials comparing the trans-thoracic and trans-abdominal approaches.

Thoracic surgeons suggested that it is easier to fully mobilize the oesophagus from above to decrease oesophageal tension <sup>6</sup>. However, there was also higher incidence of short oesophagus reported and an increased need for a Collis gastroplasty for oesophageal lengthening <sup>6</sup>. One study reported that 96% of patients required a Collis gastroplasty, with up to 4% of patients developing staple line leaks postoperatively <sup>7,8,9</sup>. The transthoracic approach also brings increased pain, higher risk of pulmonary complications associated with single lung ventilation and longer hospital stay <sup>10</sup>. Overall morbidity rates for transthoracic hiatal hernia repair have been reported to range from 8-42% <sup>8</sup>.

The laparoscopic trans-abdominal approach offers good visualization of the hiatus and allows for efficient mobilization of the oesophagus. Surgeons with advanced laparoscopic experience should perform the dissection and exposure in this approach. Complications such as bleeding from the spleen may be encountered and require advanced laparoscopic skill sets for control.

Initial reports of laparoscopic paraesophageal hernia repairs documented high recurrence rates compared to the open approach<sup>11</sup>. In a ten-year retrospective audit of paraesophageal hernia repairs at their centre, Hashemi et al<sup>11</sup> reported greater recurrence after laparoscopic repair (42% vs 15%;  $P < 0.01$ ). It was interesting that these recurrences were identified radiologically and did not necessarily correlate with clinical symptoms. One decade later, however, Zehetner et al<sup>12</sup> demonstrated that the recurrence rates were similar between the two techniques with attention to technical details and the use of mesh.

Some key technical factors that reduce the chances of recurrence are reduction of the stomach to its intra-abdominal location followed by complete mobilization and excision of the hernia sac and the use of mesh. It is theorized that removal of the peritoneal lining of the hernia sac prevents the development of pleural collections that may contribute to hernia recurrence<sup>13, 14</sup>. In our case, data supported the use of mesh used to reinforce the posterior sutured cruroplasty. Oelschlager et al<sup>15</sup> published results from their randomized controlled trial demonstrating that the radiologic recurrence rates six months after repair was lower when biologic prostheses were used to repair para-oesophageal hernias (9% vs 24%).

Oelschlager et al<sup>16</sup> published a second phase of their study in 2011 that aimed to determine the long-term durability of biologic mesh. Interestingly, they demonstrated that laparoscopic hiatal hernia repair, with or without mesh, resulted in improved quality of life and durable symptom relief at five years follow-up. Oelschlager et al<sup>16</sup> also found that the benefit of reduced recurrence imparted by mesh was lost after five years. It was theorized that the biologic mesh was absorbed by this time and no longer reinforced the repair. There is no consensus on the type of prosthetic mesh that should be used in these cases. Frantzides et al<sup>9</sup> published results of a randomized control trial demonstrating that polytetrafluorethylene mesh reinforcement resulted in significantly lower recurrence rates compared to repair by primary sutured cruroplasty. However, there is much heterogeneity in the medical literature, making it difficult to establish consensus at this time. Currently, there is no consensus on the technique for sutured repair, the use of prostheses, the shape of the mesh to be used, how to secure mesh or even the definition of a recurrence.

In 2016, Memom et al<sup>17</sup> published results of a meta-analysis that compared primary sutured cruroplasty with prosthetic hiatal herniorrhaphy for large hiatal hernias. They could not recommend routine prosthetic hiatal herniorrhaphy and suggested that the decision should be individualized based on intra-operative findings<sup>17</sup>. Tam et al<sup>18</sup> supported this recommendation in their 12-year single institution audit of para-oesophageal hernia repairs using a selective mesh reinforcement policy. The decisions for mesh reinforcement were made autonomously after the surgeons assessed crural integrity and tension after sutured approximation<sup>18</sup>. They were not able to demonstrate any difference in symptomatology or radiologic recurrence in patients who had mesh repair versus primary repair using this policy. At this point, it appears that selective mesh reinforcement is reasonable, balancing the potential risks of mesh infection and mesh erosion<sup>19</sup>.

Once the hernia sac has been reduced and the cruroplasty performed, with or without mesh, the next decision is whether an anti-reflux fundoplication is necessary. Earlier recommendations for routine fundoplication were based on the assumption that the lower oesophageal sphincter was incompetent in most patients with para-esophageal hernias<sup>20</sup>. However, the supportive evidence for routine fundoplication is weak. Morris-Stiff et al<sup>21</sup> compared 360-degree fundoplication and no fundoplication in 46 patients undergoing laparoscopic hiatal hernia repairs. They noted that most patients who had fundoplication experienced dysphagia. Another prospective study where laparoscopic Nissen fundoplication was performed for both gastro-esophageal reflux disease (109 patients) and paraesophageal hernia (40 patients) showed that the incidence of dysphagia was similar in both groups<sup>22</sup>.

Several fundoplication options have been compared in the literature. In a 20-year prospective study, Watson et al<sup>23</sup> showed that heartburn and satisfaction scores were similar for the anterior 90°, anterior 180° and Nissen 360° fundoplication. Although, the anterior 90° and 180° wraps were associated with a slightly higher incidence of heartburn compared to the Nissen fundoplication, the difference was not significant<sup>23</sup>. Watson et al<sup>24</sup> demonstrated in a separate randomized controlled trial that the anterior 180° and anterior 360° wraps have similar outcomes as a laparoscopic anti-reflux procedure.

The final point to be considered in performing these repairs is whether division of the short gastric vessels is necessary. In the index case, the short gastric vessels were not divided because there was no difficulty mobilizing the fundus of the stomach during the Nissen fundoplication. Two randomized controlled trials evaluating this demonstrated that division of the short gastric vessels brought no additional improvement in dysphagia, epigastric pain, early satiety or regurgitation at 5 years<sup>25, 26</sup>. However, the division of these vessels increased the operative time by 40 minutes, with a higher chance of bleeding from these ligated vessels<sup>25</sup>. The evidence at this point does not lend to division of the short gastric vessels.

**CONCLUSION:** Hiatal hernia repair is another operation for which laparoscopy has evolved as the preferred approach. This shift has been supported by several studies showing that laparoscopic repair has similar recurrence to open repair, but with improved morbidity, shorter hospital stay, better cosmetic results and decreased analgesia requirements. We have shown that this type of repair is feasible in the low-resource Caribbean setting.

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## ORIGINAL RESEARCH CONTRIBUTION

### Locally-Made Uterine Manipulator To Perform Laparoscopic Assisted Vaginal Hysterectomy In A Resource-Limited Setting

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## ABSTRACT

**BACKGROUND:** Laparoscopic-assisted vaginal hysterectomy is a procedure with many advantages over other types of hysterectomy. To perform this type of intervention it is necessary to use a uterine manipulator. We designed and built our own uterine manipulator from discarded basic laparoscopic instruments. This study was designed to assess the technical feasibility and safety of the locally designed uterine manipulator to perform laparoscopic-assisted vaginal hysterectomy.

**METHODS:** We carried out a prospective study of all consecutive patients who underwent laparoscopic assisted vaginal hysterectomy over a six year period from 2009 to 2015 using the uterine manipulator in a standard 4-port technique. The following data were collected from study participants: age, body mass index (BMI), estimated uterine weight in grams, operative time, intraoperative blood loss, intraoperative and postoperative complications, transfusion requirements, conversions to open surgery, hospital stay and re-interventions.

**RESULTS:** There were 84 laparoscopic assisted vaginal hysterectomies performed over the study period. The average age of the patients was 42 years. The most common indication for hysterectomy was uterine fibroids in 72 patients. The average weight of the surgical specimen was 264 grams (range 200-320). The average operative time was 140 minutes (Range: 96-190) and mean intraoperative bleeding was 132 ml. There were no conversions to laparotomy in any case. The mean duration of hospital stay was 25 hours (range: 18-96) and no deaths were reported.

**CONCLUSIONS:** It is feasible and safe to perform laparoscopic assisted vaginal hysterectomy for benign uterine diseases using this locally made articulated uterine manipulator. The design is suitable for use in other resource-poor hospitals that do not yet perform this technique due to lack of equipment.



**BACKGROUND:** Hysterectomy is the second most frequently performed surgery in women of reproductive age, surpassed only by cesarean section <sup>1,2</sup>. Before the introduction of laparoscopic hysterectomy by Harry Reich in 1989, 75% of all hysterectomies were performed through the abdominal route and the remaining 25% through the vaginal route <sup>3</sup>. Laparoscopic hysterectomy has had slow growth in the surgical community due to multiple factors, but due to its advantages it has been established as an effective and desirable surgical route <sup>4</sup>.

To perform this type of intervention it is necessary to use a uterine manipulator - a device that allows the mobilization of the uterus by permitting ante-flexion, retro-flexion, bending and lateralization. These movements are necessary to properly expose the uterus, tense the uterine ligaments away from the ureters in danger areas, facilitate dissection and allow exposure of the vaginal vault for safe opening, among other functions. Many models have been designed with various technical features and attachments that allow most or all steps to be performed laparoscopically <sup>5-9</sup>.

In our hospital advanced minimally invasive surgery began with laparoscopic-assisted vaginal hysterectomy in 2009. Since we do not have the budget to buy any of the commercial uterine manipulator models available on the international market, we were forced to design and build our own instrument. Therefore, we designed a uterine manipulator from used and discarded basic laparoscopic instruments (Figure 1). A threaded tip was fabricated and added to an articulated mechanism allowing angulation of up to 65°. This instrument can be completely disassembled to facilitate cleaning (Figure 2), but it lacks vaginal dome and pneumo-occlusion highlighters - accessories that are present in most of the models available on the commercial markets. Once our uterine manipulator was constructed, we used it to perform the laparoscopic assisted vaginal hysterectomies. The aim of this study was to evaluate the technical feasibility and safety of the new instrument created for laparoscopic-assisted vaginal hysterectomy.



**Figure 1:** Photograph of the uterine manipulator showing the threaded tip on an articulating tip that allows flexion to 45°



**Figure 2:** Photograph of the uterine manipulator that has been disassembled to facilitate cleaning

**METHOD:** This study was approved by the local scientific council and ethics committee at our institution. All patients gave their approval to be included in the study and to provided informed consent for laparoscopic-assisted vaginal hysterectomy using the locally designed uterine manipulator. The uterine manipulator had a threaded and articulated tip designed by our team of researchers and from pieces of used, discarded instruments.

Patients at this institution were offered the laparoscopic-assisted approach once they met the clinical indications for total hysterectomy to treat benign disease and met the inclusion criteria: estimated uterine weight measured by preoperative ultrasound  $\leq 300$  grams. The exclusion criteria included patients with: added pathologies that contraindicated laparoscopic surgery, indications for vaginal hysterectomy, gynecological cancers, estimated uterine weight  $>300$  grams and those who refused to participate in the study.

All operations were performed by a single team composed of three expert laparoscopic surgeons and one gynecologist experienced in hysterectomies via the vaginal route. A standardized 4-port technique was used. Lacking a vaginal dome highlighter and pneumo-occlusive diaphragm manipulators, the dissection of the round ligament, utero-ovarian ligaments, broad ligament, uterosacral ligaments and uterine artery was performed using bipolar coagulation and scissors during laparoscopy. The colpotomy was made through the vaginal route with the surgeon sitting between the patient's legs, thus removing the uterus and closing the vaginal vault in this way.

We prospectively recorded data from all consecutive patients undergoing laparoscopic assisted vaginal hysterectomy using the locally designed uterine manipulator in our institution over a six-year period from January 1, 2009 to December 30, 2015. The data collected included: age, body mass index (BMI), estimated uterine weight measured in grams, surgical time, intraoperative blood loss, intraoperative and postoperative complications, need for intraoperative and postoperative transfusion, conversion to open surgery, hospital stay and re-interventions. The information was collected in a data collection tool designed for this purpose. Summary measures were used for qualitative and quantitative data (absolute figures, percentage, mean), for better interpretation of the results.

**RESULTS:** There were 84 laparoscopic assisted vaginal hysterectomies performed using the uterine manipulator over the study period. The procedures were performed in women at an average age of 42 years (Range 27 - 56 years).

The commonest indication for surgery was uterine myomatosis (72), followed by abnormal uterine bleeding (8) and adenomyosis (4). There were 18 (21.4%) patients who had prior operations via lower abdominal incisions: caesarean sections (12) and tubal ligations (6). Table 1 outlines the demographic features of the study population.

<b>Table 1: Characteristics of Patients Included in the Study</b>	
<b>Characteristics</b>	<b>Value (Range)</b>
Mean age in years	42 (27-56)
Mean BMI in Kg/M <sup>2</sup>	27 (18.7-29.8)
Mean uterine weight in grams	264 (200-320)

The laparoscopic-assisted vaginal hysterectomies were completed in a mean operative time of 140 minutes (Range 96-190). There were no conversions to laparotomy in this series. These patients had a mean post-operative hospital stay of 25 hours (range 18-96). Table 2 outlines the clinical outcomes in the patients undergoing laparoscopic-assisted vaginal hysterectomies.

The mean operative blood loss was 132mls (range 25-900). However, there was profuse intraoperative bleeding in one patient that was due to technical problems with the bipolar forceps while controlling the uterine artery. In one patient, the post-operative course was complicated by bleeding, necessitating re-operation by the open approach. At operation, there was a hemoperitoneum present that was due to bleeding from the pelvic venous plexus that required operative control.

One patient developed a uretero-vaginal fistula seven days after surgery. The fistula was repaired laparoscopically in the National Center for Minimal Access Surgery. We did not have any episodes of uterine perforation, injuries to neighboring organs or misalignment of the instrument during the performance of the laparoscopic assisted vaginal hysterectomy.

<b>Table 2. Clinical Outcomes in Patients Undergoing Laparoscopic Assisted Vaginal Hysterectomy</b>	
<b>Parameter</b>	<b>Value (%)</b>
Intra-Operative Complications	1 (1.1%)
Post-Operative Complications	2 (2.3%)
Patients Requiring Transfusion	2 (2.3%)
Conversion to open surgery	0 (0)
Operative Re-interventions	2 (2.3%)

Regarding the technical-operative behavior of the uterine manipulator, we point out that placement was easy in all cases and only 12 (14.3%) patients required dilation of the external cervical os and cervical canal with Hegar dilators. The intra-operative movements of pulsation, flexion, version and lateralization of the uterus were facilitated by the articulated mechanism. With up to 65° of angulation, the manipulator was effective in allowing exposure and management of the uterine ligaments and the vascular pedicle. The fact that part of the procedure was performed vaginally also eliminated the need for more angulation. The instrument was found to be user-friendly and the learning curve was short.

**DISCUSSION:** Since its first description by Harry Reich in 1989, laparoscopic hysterectomy has been accepted as feasible and safe <sup>10</sup>. Laparoscopic hysterectomy has proven advantages over the open abdominal technique that include reduced bleeding, less postoperative pain, shorter hospitalization, faster return to daily activities and cost savings <sup>10</sup>. Although there are proven advantages, its adoption in clinical practice has been slow and is limited by multiple factors <sup>11</sup>.

The uterine manipulator is an essential tool when performing this operation because it is used to mobilize the uterus during the operation and to clearly identify the vagino-cervical union during the colpotomy, thus decreasing the possibility of vesico-ureteral injury and surgical time <sup>12</sup>. Although reports have been published on the technical feasibility of performing a laparoscopic hysterectomy without a uterine manipulator, an endless number of models, each with diverse characteristics, have been designed: articulated and fixed, metallic and plastic, reusable and disposable <sup>13-15</sup>.

A recent publication that examined models commonly used in surgical practice, identified the least desirable qualities of a uterine manipulator to be excessive weight, those manufactured from plastic materials and those comprised of many smaller pieces <sup>5</sup>. The uterine manipulator designed by our team weighs 208 grams, is completely metallic and consists of only 3 parts which makes it very light, easy to use and simple to disassemble and clean. Using the Kano model for product development, García Baños et al <sup>9</sup> evaluated these three design characteristics as being desirable and advocated local manufacture of the uterine manipulator. By distributing the manipulator nationally, it would allow adoption of the laparoscopic-assisted vaginal hysterectomy technique in hospitals country wide, without the need to import costly commercial models available on the international market <sup>9</sup>.

In our opinion, the articulated tip that allows up to 65° of angulation is an important feature. This facilitates uterine exposure, especially in patients who are obese and with a narrow pelvis. Proper exposure should help to reduce operative complications, such as ureteric injuries. The simplicity of the assembly and disassembly was another advantage of this design because it allowed easy cleaning and sterilization.

There are limitations, however. Firstly, the absence of a dome highlighter and pneumo-occluders, limits the ability to complete a totally laparoscopic hysterectomy. Therefore, once the uterine vascular pedicles are controlled, we open the vaginal vault and finish the operation, thus performing a type 4 laparoscopic hysterectomy of the Richardson classification <sup>16</sup>. As far as we know, no comparative studies have been published between laparoscopic-assisted hysterectomy (type 4 of the Richardson classification) and totally laparoscopic hysterectomy (type 5 of the Richardson classification). However, most authors who publish on the subject agree that a totally laparoscopic hysterectomy is superior because it consumes less surgical time and provides better exposure, thereby minimizing intraoperative complications <sup>17-19</sup>. In order to improve on our design, we plan to include a plastic dome that will allow the surgeon to perform the colpotomy incision via a laparoscopic route.

Another limitation is the absence of a locking mechanism to keep the articulated part in position during the operation. This can contribute to muscle fatigue in the assistant. To overcome this, we are exploring new designs in which the simple handle is being replaced by a handle with a "zipper" that allows handle fixation without manual effort.

We have shown that performing a laparoscopic-assisted vaginal hysterectomy using the uterine manipulator is feasible. Although we only included patients with benign diseases, the technique can also be extended to patients with malignant uterine pathologies <sup>20</sup>. Also, it should be noted that none of the patients in our series were obese and the uterine weight did not exceed 320 grams. These are well-documented predictors of post-operative complications during laparoscopic hysterectomies <sup>21-23</sup>.

In our series, the operative times were higher than those reported by Barreras González <sup>24</sup> from the National Center for Minimum Access Surgery - a specialist centre with extensive experience. But the operative time was within the range published by other authors (table 3) <sup>2,24-25</sup>. Like most surgeons who are dedicated to this type of procedure, we believe that the surgical time decreases when approximately 50 procedures are exceeded and the learning curve is flattened, but it increases when the surgeon begins to tackle increasingly complex cases, such as those in patients with obesity, uterine weight >500 g and associated gynecological diseases <sup>26</sup>.

**Table 3: A Comparison of Post-Operative Outcomes with Published Data**

Citation	Year	No. of patients	Mean Operating time	Mean blood loss	Overall morbidity	Mean stay in hospital	Conversion (%)
Saleem Dojki et al. 31	2018	209	175 mins	164 mls	12.3%	3 days	3.3
Sinha et al. 32	2018	128	107 mins	186 mls	7.4%	2 days	10.9
Zeng et al. 34	2015	18	107 mins	225 mls	-	-	0
Argüello-Argüello et al. 33	2012	748	90 mins	213 mls	5.6%	-	2
Aragón et al.		84	140 mins	132 mls	2.3%	1 day	0

In addition to demonstrating its feasibility, we have also shown that the procedure is safe. The mean blood loss, transfusion requirements and morbidity rates were lower than that reported by Nieboer et al <sup>27</sup>, although our study is limited by small patient numbers and short follow-up. The complication rate in our study is similar to that reported by Pather et al <sup>28</sup> and Donnez et al <sup>29</sup> and the feared urinary tract injuries are within the permissible range established for this type of procedure <sup>28-30</sup>. Only one of the two patients with re-interventions required prolonged hospitalization, with up to 96 hours of hospital stay. Excluding this outlier, the remaining patients had satisfactory post-operative recovery periods that made it possible to discharge them around 24 hours. This contributed to the cost-effectiveness of the procedure and the satisfaction of our patients. Generally, these results compare favorably with those reported by other authors <sup>31-34</sup>.

**CONCLUSIONS:** The performance of laparoscopic assisted vaginal hysterectomy with the locally manufactured uterine manipulator is feasible and safe for the treatment of patients with benign diseases of the uterus. Its design and use could be implemented in other hospitals in the country that do not yet perform this technique for lack of this important device.

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## INVITED REVIEW

### Caribbean College of Surgeons: History of the College

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**INTRODUCTION:** The Caribbean is an archipelago of islands stretching from the Bahamas off the Floridian coast of the United States to Trinidad & Tobago off the Venezuelan coast of the South American continent. The history, language, culture and medical practices of the islands are intimately bound up in the colonization of the European powers, leaving it with a variety of governance structures and languages. The most common language among the islands is English, and those islands, along with the Central American territory of Belize and the South American territory of Guyana, have a variety of cultural, educational and governmental bonds that see them engage in linkages on the world stage such as the West Indies Cricket Team, the University of the West Indies, and the CARICOM Single market and economy. Amidst these cooperative linkages, forged across the barriers of the Caribbean Sea, most of the Caribbean territories have become independent of the Colonial powers, and remain highly individualistic in their institutional structures.

**SURGICAL SERVICES:** In some of the island territories, their populations were served by only one or two surgeons, producing a sense of isolation that was only relieved by travelling to the metropolitan countries, whose practices were difficult to reproduce with the restrained resources of a small island. The larger English speaking territories of Jamaica and Trinidad had within their boundaries some similar circumstances of isolation in the rural areas as were found in the small islands. Such isolation was relieved by the formation of organizations such as the Association of Surgeons in Jamaica, and the Society of Surgeons in Trinidad & Tobago.

It was a long-standing dream of isolated surgeons in the smaller islands that they should be able to have a body where they could share experiences. Such a concept was not easy to institute for with the precious time that such surgeons had away from their territories, they had been accustomed to returning to the United Kingdom where most of them were trained. Indeed, such training out of the Caribbean would prove to be the unwitting stimulus to the formation of a Caribbean wide body of surgeons.

#### **FORMATION OF THE CARIBBEAN COLLEGE OF SURGEONS:**

The University of the West Indies (UWI) was the first institution set up to link the colonial territories of the English-speaking Caribbean. It was opened in 1948, with the Faculty of Medicine to train doctors to serve the general needs of the Caribbean. There was no thought given to specialty training and by the 1960's, the region experienced a noticeable 'brain drain' where medical professionals left for specialty training outside of the region. Most of those who left for the United States and Canada did not return to practice in their Caribbean island homes. One solution proposed was to set up postgraduate training in the region.

The UWI and the medical professionals in the region were hesitant to embark on professional postgraduate training because their traditional ties pointed to the Royal, American and Canadian Colleges as the appropriate province for such training. The absence of such colleges determined that the UWI would in fact undertake that specialty-training role, which it continues to fulfill nearly 50 years later.

The idea of the development of Caribbean Specialty Colleges was generated with the introduction of postgraduate training at the UWI in the early 1970's. By the 1990's the idea of a Caribbean College of Surgeons was rekindled by the UWI staff and the graduates of the UWI Doctorate Medicus (DM) postgraduate programmes as they did not envisage the university as a suitable body to host and nurture a body of medical specialists. The traditional ties to the British, American and Canadian Colleges were deeply rooted and the heads of the Surgery Departments at UWI thought that a catalyst to a meeting of surgeons from around the Caribbean would be to invite the Royal College of Surgeons of England to hold one of its overseas meetings in the Caribbean, in conjunction with the Department of Surgery at UWI. The invitation was extended to hold such a meeting in Barbados. Meanwhile, discussions among the DM graduates and their teachers continued as to what a Caribbean College of Surgeons would look like, and it was envisioned that DM graduates of the UWI would be entitled to be Fellows, as would be the Fellows of the Colleges in the UK, North America and Canada.

The Royal College of Surgeons of England accepted the invitation and held a meeting in Barbados in March 2001. As hoped, there was a large response from surgeons from around the Caribbean. Informal arrangements were made to have other Caribbean surgeons present during the joint Royal College of Surgeons / UWI Department of Surgery meeting. The intention to propose the formation of a College was concretized when Royal College officials also suggested that the regional surgeons should join together as a college, and pledged to give support for the conduction of skills workshops for trainees and surgeons. A steering committee of four persons was asked to develop the instruments needed to make the College a reality.

Professor Errol Walrond from the UWI in Barbados was asked to chair the committee; the other members were Mr now Sir Cecil Cyrus from St. Vincent - the doyen of the 'small island' surgeons, Mr Denis Ronald Duquesnay from UWI in Jamaica - a graduate of both the DM and a Royal College who had done preliminary work on a constitution for such a college, and Dr. Terry Ali from the UWI in Trinidad & Tobago - a DM graduate in orthopaedic surgery.

Over the next year, the constitution was discussed and legal arrangements were concluded in 2002 for the incorporation of **THE CARIBBEAN COLLEGE OF SURGEONS INC.** as a non-profit company under the Companies Act of Barbados.

The College logo (figure 1) was conceptualized by Professor Paul Ramphal while he was a resident in thoracic surgery. It depicts the chain of islands without identifying individual countries, instead depicting simple recognition of the English Speaking Caribbean as one unit. The blue background represents the Caribbean Sea that binds the individual islands together and the winged Caduceus is coloured gold to depict the bright Caribbean sun. The staff of Hermes was converted to a scalpel to represent the surgical discipline.



**Figure 1:** The logo of the Caribbean College of Surgeons.

## INAUGURATION OF THE COLLEGE

Arrangements were made to hold the first formal meeting of the College in Trinidad & Tobago in June 2003. The place and date were chosen to coincide with the end of the UWI exams, as surgeons from the campuses in Jamaica and Barbados would already be assembled there and surgeons from the other territories would find it easy to travel there. The Caribbean College of Surgeons (CCOS) was formally launched at the Kapok Hotel, Port-of-Spain, Trinidad in June 2003 at which the following executive was elected:

<b>CCOS President:</b>	Prof. E. R. Walrond [Barbados]
<b>CCOS Vice President:</b>	Prof. Vijay Naraynsingh [Trinidad & Tobago]
<b>CCOS Secretary:</b>	Dr. Andrew Richardson [St. Lucia]
<b>Council Members:</b>	Prof. Peter Fletcher [Jamaica]
	Dr. Ramesh Jonnalagadda [Barbados]
	Dr. Archibald McDonald [Jamaica]
	Dr. Deen Sharma [Guyana]
	Dr. Cameron Wilkinson [St. Kitts & Nevis]

The President was elected for a term of two years, and could be re-elected for another term. The Secretary and the Treasurer were elected for two-year terms, and could be re-elected for up to five terms. Council members initially had staggered appointments of two and three years, that could be renewed for another term. This attempted to introduce diversity among the territories as well as some continuity from one year to the next.

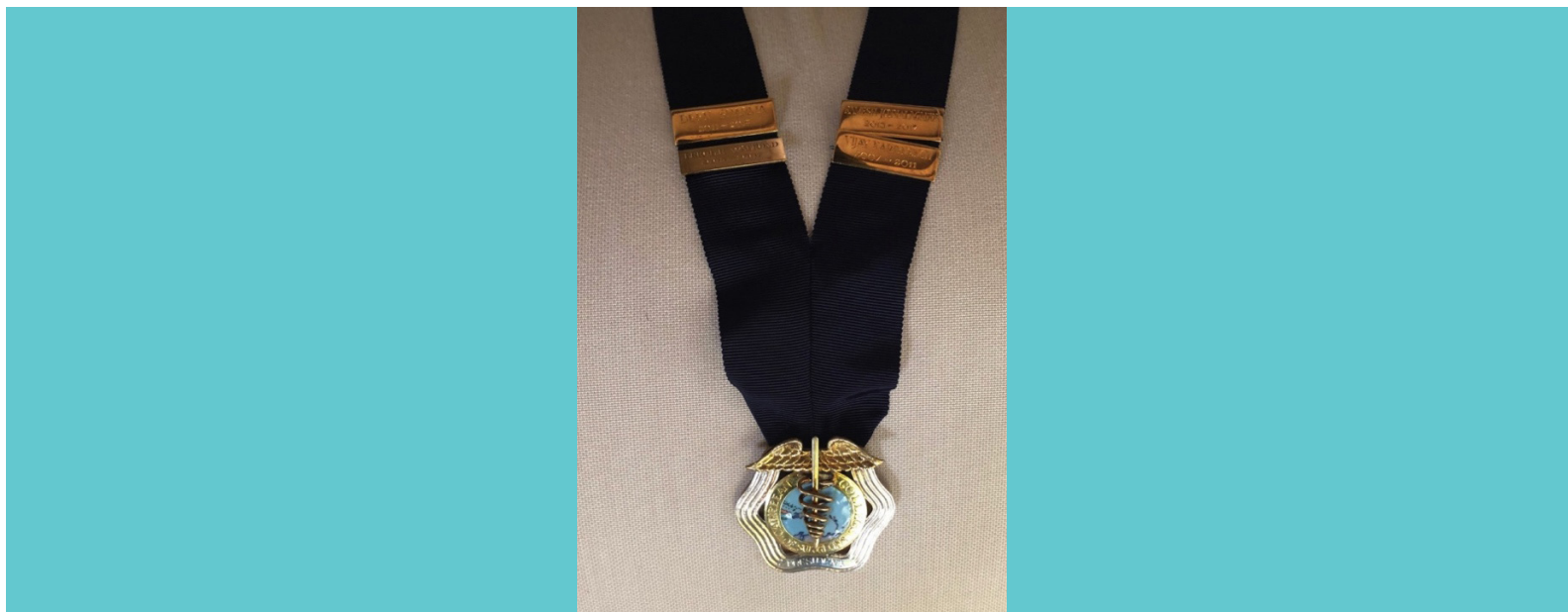


**Figure 2: A Photograph of the Presidents of the Caribbean College of Surgeons.**

*From left to right: Dr. Deen Sharma, Prof. Sir Errol Walrond, Prof. Vijay Naraynsingh, Dr. Ramesh Jonnalagadda and Dr. Cameron Wilkinson (current president).*

Since then, the College has had annual meetings (held on the second weekend in June) in Antigua (2004), Barbados (2005), Jamaica (2006), St. Lucia (2007), Bahamas (2008), St. Kitts (2009), Guyana (2010), Grenada (2011), Tobago (2012), British Virgin Islands (2013), Curacao (2014), Barbados (2015), St. Lucia (2016), Jamaica (2017), St. Kitts (2018) and Guyana (2019).

Prof. Sir Errol Walrond from Barbados served as President for two terms from 2003-2007, Prof. Vijay Naraynsingh from Trinidad & Tobago served from 2007-2011, Dr. Deen Sharma from Guyana served for the period 2011-2015, Dr. Ramesh Jonnalagadda from Barbados served from 2015-2017 and Dr. Cameron Wilkinson from St. Kitts is the sitting president serving from 2017 to 2021. A photograph of the CCOS past presidents is presented as figure 2. The Presidential Badge (Figure 3) was donated by Prof. David Rosin an Honorary Fellow of the College and now resident in Barbados at the College meeting in 2007. The presidents name plates were donated by another Fellow to the College 10 years later.



**Figure 3:** Presidential Badge for the Caribbean College of Surgeons

At its annual meetings the College has an active programme for surgeons in training, opening the conference with educational lectures delivered by senior surgeons, and a closing with sessions dedicated to case presentations and papers from trainees. Visiting experts provide guest lectures among the programme of research and practice experience by Caribbean surgeons. The programme also includes a dedicated session where a case with Ethical/ Legal issues is presented and there is commentary on the issues raised by a senior member of the College.

In the year, 2013 the College began to publish all proceedings from the annual meetings as abstracts in a supplement of the West Indian Medical Journal. In 2017, the College began to publish its own journal – the Journal of the Caribbean College of Surgeons (J.C.C.S.) – and all proceedings of the annual meetings are now published as abstracts in J.C.C.S. supplements.

The Annual meetings usually have an active social programme to encourage members to bring their families, and culminates in a banquet at which Honorary Fellowship is bestowed on Surgical luminaries or Allied Fields from the host territory, to Caribbean Origin Surgeons who have distinguished themselves in their fields outside the Caribbean, or to other Surgeons or Officials of Colleges that contributed to the development of the College. Among the distinguished Surgeons and practitioners honoured for their practise and service in the Caribbean territories were:

- Dr. Terry Ali (Trinidad & Tobago)
- Prof. Allan Butler (Trinidad & Tobago)
- Prof. Reginald Carpenter (Jamaica)
- Hon. Sir Cecil Cyrus (St. Vincent)
- Dr. Ronald Duquesnay (Jamaica)
- Hon. Dr. Rufus W Ewing (Turks and Caicos)
- Dr. Earl Farrington (Bahamas)
- Prof. Peter Fletcher (Jamaica)
- Dr. Desmond Fosberry (St. Kitts & Nevis)
- Mr. Owen King (St. Lucia)
- Dr. Herbert Marius (St. Lucia)
- Dr. Ellis Martis (Curacao)
- Dr. Halsey McShine (Trinidad & Tobago)
- Dr. Albert Penco (Trinidad & Tobago)
- His Excellency Sir Cuthbert Sebastian (St. Kitts & Nevis)
- Dr. Deen Sharma (Guyana)
- Sir Kennedy Simmons (St. Kitts & Nevis)
- Hon. Dr. Orlando Smith (British Virgin Islands)
- Prof. Sir Errol Walrond (Barbados)

The Committees of Council include an Ethical and Legal Committee and a Standards Committee. Documents for the guidance of members have included Medical Records, Referral Practices and a Code of Conduct.

The Caribbean College of Surgeons has become a recognized Caribbean institution and it continues to pursue its mandates to promote the advancement of the practice of surgery, stimulate research, encourage continued medical education, support colleagues and fostering fellowship among the surgeons of the Caribbean and the wider world.



## ORIGINAL RESEARCH CONTRIBUTION

### A Simple Technique to Prevent Patella Tendon Avulsion During Total Knee Arthroplasty

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## ABSTRACT

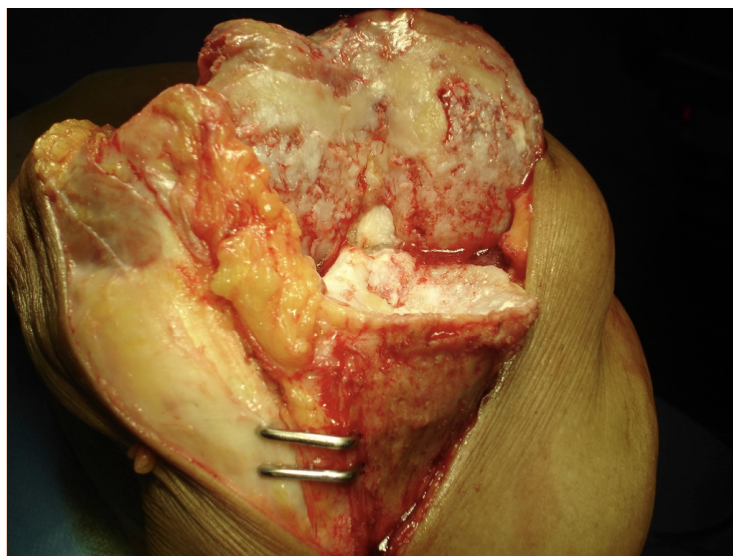
*Iatrogenic patella tendon disruption during routine total knee replacement may lead to potentially devastating complications. We propose a simple, easily reproducible technique using inexpensive and readily available equipment in the operating room that may minimize the risk of patella tendon disruption.*

**INTRODUCTION:** Patello-femoral complications following total knee replacement have been reported in 1-12% of cases, of which up to 2.5% are caused by extensor mechanism rupture and 0.2% of cases attributable to rupture of the patella tendon in the peri-operative period <sup>1,2</sup>. Unfortunately there are no statistics from the Caribbean region on the incidence of this complication.

This is important because, despite complex reconstructive procedures, these complications can have devastating consequences with many patients never regaining satisfactory knee function <sup>3,4</sup>. Avoidance of this complication is of paramount importance and highlights the need to minimize the risk of damage to the patella tendon during surgery.

We propose a simple technique that can be utilized in the operating theatre to minimize the risk of iatrogenic patella tendon disruption during routine total knee replacement.

**TECHNIQUE:** During total knee replacement, a medial para-patellar arthrotomy is made to gain access to the knee joint. Before the patella is dislocated or subluxed, a simple bone staple is impacted across the proximal aspect of the medial one-third of the patella tendon, about 2.5 cm below the level of the tibial plateau. The staple is placed such that it straddles the tendon and tibia, a second staple is then placed parallel and 1.0 cm below the level of the first staple, thereby reinforcing the patella tendon's attachment to the tibia. (Fig 1.)



**Figure 1:** Intra-operative photograph showing of an open right knee and highlighting placement of the staples at surgery.

The knee can then be flexed slowly, allowing the patella to sublux or dislocate laterally. These staples do not interfere with either extra-medullary or intra-medullary tibial jigs and they do not hamper the stem of the tibial base plate. They can be left undisturbed until the end of the procedure.

**DISCUSSION:** Previous studies have reported a 0.2% incidence of patellar tendon ruptures in the peri-operative period following total knee replacement<sup>1</sup>. Techniques of repair or reconstruction are technically challenging and yield less than satisfactory clinical outcomes<sup>3</sup>. Focus has therefore been on techniques that can prevent this devastating complication. Prior studies have identified the patients at risk for this complication, including those with obesity, limited preoperative knee movement, diabetes mellitus, chronic renal failure and rheumatoid arthritis<sup>5</sup>.

Careful surgical technique is of paramount importance to avoid excessive tension being placed on the patella tendon. It is also essential for the surgeon to dissect the postero-medial aspect of the proximal tibia to at least the mid coronal plane to allow the tibia to rotate out from under the femur. Several authorities have described techniques to reduce the risk of patella tendon avulsion while allowing good surgical access<sup>6,7,8</sup>.

To reduce the risk of patella tendon avulsion, some surgeons advocate patella subluxation rather than dislocation in high-risk patients. In a laboratory experiment, Ryan et al<sup>5</sup> demonstrated that the mean load at ultimate failure was lower when the patella was everted rather than subluxed at the side, with initial failure starting at the insertion of the patella tendon to the tibial tubercle. This suggested that patella subluxation was preferable during surgery<sup>5</sup>. However, a contrasting study published by Reid et al<sup>9</sup> showed that subluxation of the patella led to increased risk of damage to the patella tendon and poor visualization of the lateral tibial plateau, which could result in component malposition and early failure. Hence the position of the patella during surgery continues to be controversial.

Repair of an acutely ruptured patella tendon can be performed by direct reattachment to the proximal tibia using suture anchors or drill holes. Some surgeons advocate augmenting simple repair with either allograft or autograft to reduce the risks of failure<sup>10,11</sup>. A study by Cadambi and Engh<sup>10</sup> reported a mean extensor lag of 10 degrees and flexion of only 79 degrees, while another study by Leopold et al<sup>11</sup> reported a high failure rate, with reduced ambulatory ability of the patients. The existing body of evidence reveals that general repair techniques have not had satisfactory clinical results and has largely been associated with high complication rates.

The technique we described utilizes a simple metal staple to stabilize the patella tendon at its insertion into the tibial tuberosity. Ryan et al<sup>5</sup> demonstrated that this is the area that fails first during knee replacement, irrespective of whether patella is subluxed or dislocated. Therefore, we feel that reinforcement with the proximal staple is likely to reduce the risk of iatrogenic rupture.

In contrast to the technique described by Dodds and Keene<sup>6</sup>, this technique does not require an assistant during exposure. An additional advantage is that the staples can easily be left in place until the operation is completed because they do not interfere with intra-medullary alignment rods or tibial stems<sup>6</sup>. Other advantages of this technique include its simplicity, ready availability of staples and low cost (USD \$3.00/staple).

Currently, we use this technique in approximately 5% of primary knee replacements and in all cases of revision. To date, there have been no patella tendon ruptures and we have experienced no complications related to use of the staples.

**CONCLUSION:** This is a simple technique that can be utilized in the operating theatre to minimize the risk of iatrogenic patella tendon disruption during routine total knee replacement. We recommend employing this technique in high-risk cases where exposure places the patella tendon at increased risk of iatrogenic rupture.

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## ORIGINAL RESEARCH CONTRIBUTION

### Melanosis Coli: An Unexpected Finding at Colonoscopy and a Cautionary Message to the General Surgeon

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## ABSTRACT

**BACKGROUND:** *We report a case of melanosis coli to increase the awareness of this entity and avoid misdiagnosis and mismanagement.*

**REPORT OF A CASE:** *We report colonoscopic findings of black pigmentation in the mucosa of the colon, extending from the anus to the cecum and the distal ileum. This was secondary to ingestion of an anthranoid laxative. Melanosis coli was confirmed on biopsy. The pigmentation was unchanged one year later after stopping the laxative.*

**CONCLUSION:** *Melanosis coli can affect the entire colon, without mucosal sparing. It can also affect the distal ileum and may persist for over a year after the causative agent is stopped.*

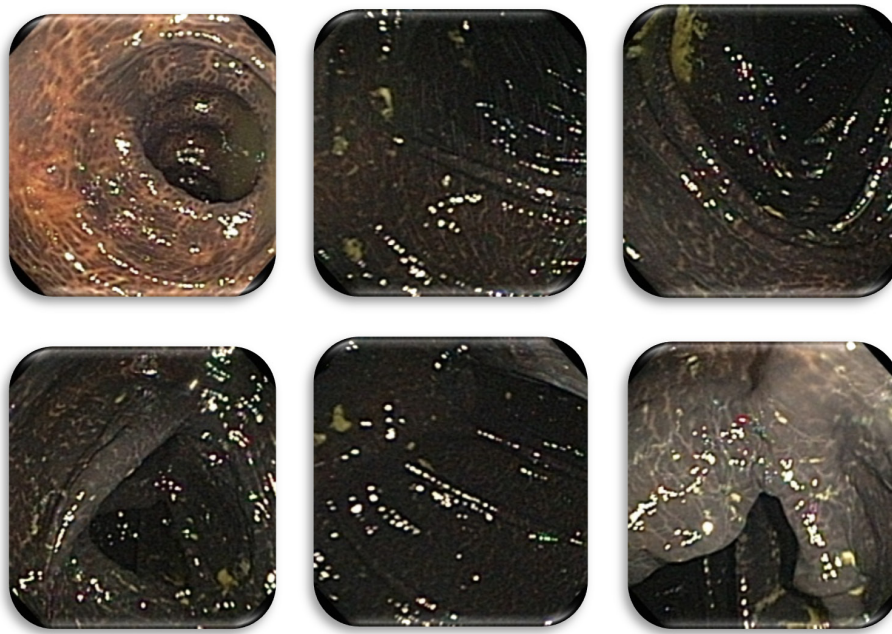
**INTRODUCTION:** Melanosis coli is the term used to describe the dark discoloration of the colonic mucosa associated with long-term use of anthranoid-containing laxatives <sup>1</sup>. The incidence in clinical series range from 1.3% to 17.7% <sup>2</sup>, but autopsy studies have reported a higher incidence of 59.5% <sup>3</sup>.

Melanosis coli may surprise unsuspecting surgeons, leading to misdiagnoses, unnecessary surgical interventions or overtreatment <sup>2,5</sup>. We present a case of extensive melanosis coli in order to familiarize the surgeon with this disease.

**REPORT OF A CASE:** A 69 year-old Afro-Caribbean woman complained of constipation and chronic abdominal pain. She was known to have hypertension that was controlled on amlodipine, lisinopril and furosemide. In order to relieve her constipation, she regularly used a herbal supplement known as ColonMax that contained magnesium oxide, aloe, rhubarb root, slippery elm bark, marshmallow root and triphala (a blend of chebulic myrobalan, amla and belleric myrobalan fruits).

A colonoscopy was ordered to interrogate the bowel. Magnesium citrate was used for the bowel preparation. At colonoscopy, there was increasingly dark discoloration of the colonic mucosa extending from the anus to the ileo-cecal valve. As the scope was advanced, the pigmentation became more pronounced and visibility decreased. The cecum was jet black in colour and the discoloration could be seen extending into the distal ileum. The mucosal changes encountered are demonstrated in figure 1 and can be compared with mucosa in a normal patient as demonstrated in figure 2.



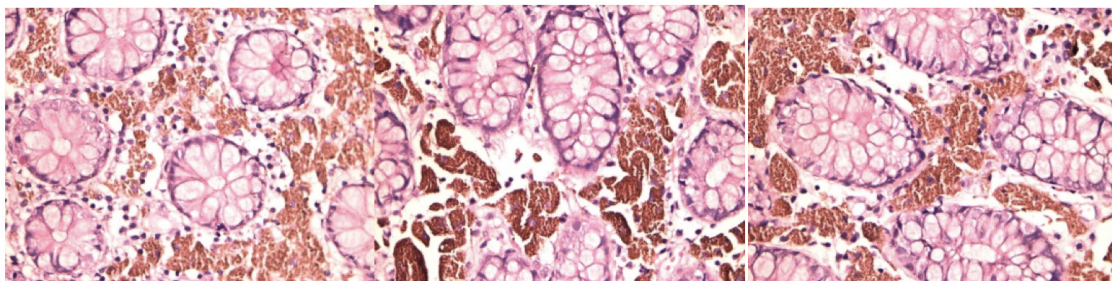


**Figure 1:** Colonoscopic images demonstrating black coloration of the colonic mucosa. As the scope progressed, the visibility decreased significantly



**Figure 2:** Images from an un-related patient demonstrating normal colonic mucosal for comparison

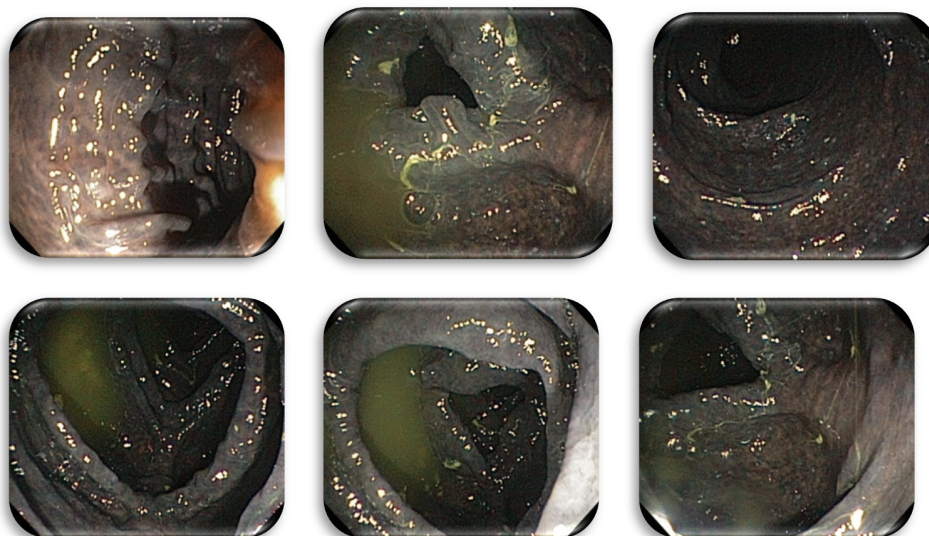
Random biopsies were taken and sent for histological evaluation. Microscopic examination showed numerous lipofuscin-laden macrophages throughout the colonic mucosa, confirming a diagnosis of Melanosis Coli (Figure 3).



**Figure 3:** Microscopic slides from random biopsies of the colonic mucosa in a patient with of melanosis coli demonstrating numerous lifosucin-laden macrophages

The herbal supplement was discontinued and she was placed on a high fiber diet. Her symptoms of constipation and abdominal pains resolved. The colonoscopy was repeated one year later. The findings were similar, showing the extensive black discoloration from the anus to the cecum and distal ileum (Figure 4).





**Figure 4:** Images from repeat colonoscopy on year after presentation

The herbal supplement was discontinued and she was placed on a high fiber diet. Her symptoms of constipation and abdominal pains resolved. The colonoscopy was repeated one year later. The findings were similar, showing the extensive black discoloration from the anus to the cecum and distal ileum (Figure 4).

**DISCUSSION:** Melanosis coli refers to dark pigmentation of the colonic mucosa secondary to the deposition of lipofuscin in the mucosal macrophages. The mucosal cells die as a result of anthraquinone in laxatives and are then phagocytosed by macrophages, producing lipofuscin that produces the discoloration. It is believed to occur after long-term laxative use and affects mainly the caecum, with rectal involvement occurring late.

Over the counter laxatives and herbal laxatives are extensively used in the Caribbean. However, a literature search did not return any reports of melanosis coli from the Caribbean. This case is the first reported case from the Caribbean and appears to be one of the few cases of melanosis coli involving the entire colon and terminal ileum.

In St. Kitts the most commonly used laxative is Senna tea that contains anthraquinone. Of 1,013 colonoscopies done at our institution over a five-year period from 2013 to 2015, this was the only case of melanosis coli encountered, despite the widespread use of Senna laxatives. This demonstrates that exposure to anthraquinone laxatives does not always result in Melanosis Coli.

As demonstrated in our case, melanosis coli can occur in as little as 4 months and can be extensive, involving the entire colon and rectum after such short usage. Most reports in the literature state that the small bowel is not often affected <sup>1,6</sup>, but the distal ileum was involved in our case.

The severity and extent of the pigmentation has no bearing on symptoms of colonic disease <sup>1,2</sup>. Our case clearly demonstrated this as our patient had severe melanosis coli, but was asymptomatic once placed on the appropriate fiber supplementation.

Our case was unique because the changes remained present at one year despite discontinuation of the laxatives. In fact, the literature suggests that it is common for changes to disappear after stopping the laxatives for one year <sup>6</sup>.

It is important for surgeons to be aware of this clinical entity because the changes may lead to misdiagnoses. There have been reports where the condition has been misdiagnosed as ulcerative colitis <sup>5</sup> and even ischaemic colitis, leading to total colectomy <sup>4</sup>.

Most authorities consider this condition is thought to be benign <sup>1,2,3,4</sup>. However, in a retrospective study of 18263 patients undergoing colonoscopy, Liu et al <sup>7</sup> reported that patients with melanosis coli had a higher incidence of non-adenomatous polyps, low-grade adenomatous polyps and distal rectal ulcers. Interestingly, they found that patients who had left-sided melanosis coli had a higher incidence of colonic polyps compared to those with changes in the left colon <sup>7</sup>. The cause of this has not yet been elucidated.

There is one advantage, however. The presence of melanosis coli increases the detection of polyps because adenomas do not take up pigment and so can be identified easily <sup>8</sup>.

**SUMMARY:** Melanosis coli is a common, benign condition of the colon that can lead to misdiagnoses and inappropriate treatment if not correctly identified. It very rarely can involve the ileum. The injurious agent, anthraquinone, is found in a number of over the counter laxatives and can lead to melanosis in a few months. Every surgeon and should be aware of this entity to avoid misdiagnosis and mismanagement.

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## ORIGINAL RESEARCH CONTRIBUTION

### A Review of Surgically Treated Penetrating Cardiac Injuries in Barbados

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## ABSTRACT

**Background:** Penetrating cardiac injuries are a significant cause of morbidity and mortality, and are not always easily diagnosed. We hypothesised that there was delay associated with the use of unnecessary imaging modalities, resulting in a delay before definitive treatment. The objective of this study was to evaluate the clinical features and results of imaging modalities and to correlate these with therapeutic outcomes in patients with penetrating cardiac injuries who presented to our institution.

**Method:** The hospital operative log at the Queen Elizabeth Hospital was audited to identify all consecutive patients who were treated for surgically confirmed penetrating cardiac injury over a 24-year period from 1994-2017. The patient's hospital records were retrieved and retrospectively analyzed.

**Results:** There were twenty-two patients who had operations to treat penetrating cardiac injuries during the study period. There was only one female patient. The time from arrival to incision ranged from 36 to 795 minutes, with a mean of 155 minutes. There were 4 deaths, for an overall mortality of 17%. Two patients had emergency department thoracotomies. Over half (55%) of patients who had a systolic BP < 90mmHg had imaging performed prior to surgery.

**Conclusion:** The survival of patients reaching the operating room alive is comparable to published data, and the best outcomes are achieved in patients who are operated on prior to cardiopulmonary arrest. This case series also demonstrated that patients with cardiac stab wounds survived for extended periods prior to surgery, and that unnecessary investigations were performed too commonly, rather than relying on the clinical condition of the patient. A protocol for the management of these patients needs to be instituted.

**BACKGROUND:** Penetrating cardiac injuries can be life threatening. They require prompt diagnosis and surgical repair, but they can be difficult to diagnose. There is the perception that there was unnecessary delay in getting these patients to surgery at our institution. This retrospective study sought to document the local experience with penetrating cardiac injuries, identify the modalities used in diagnosis and evaluate the therapeutic outcomes in these patients.

**METHODS:** The local ethics committee approved this study. We retrospectively reviewed the operating theatre log to identify all consecutive patients who had operations to treat penetrating cardiac injuries at the Queen Elizabeth Hospital in Barbados over a 24-year period from January 1994 to February 2017. Only patients who had operative confirmation of a cardiac injury were included.

Generally, the institutional protocols at this facility dictated that all patients with clinical signs of a cardiac injury or those with imaging suspicious for a cardiac injury were offered surgery.

The patients' hospital records were retrieved and retrospectively evaluated. The following data were extracted from the hospital records: patient demographics, haemodynamic data, location of the injury on the chest wall, time spent in the Accident and Emergency Department (A&E), preoperative investigations accessed, interval between presentation and incision, details of the myocardial injury, morbidity, mortality and length of hospital stay.

**RESULTS:** There were 22 patients who had surgery to treat penetrating cardiac injuries during the study period, with a mean age of 28 years (range 14 to 44 years). Of this, 68% of the patients were under 40 years of age. In this study, there was one haemodynamically stable patient with a small pericardial effusion on echocardiogram who refused surgery.

There was a preponderance of males (95.5%), with only one female in the study population. When the study period was divided equally, there were 5 patients in the first half of the study period (1994-2005), compared to 17 patients in the second half of the study period (2006-2017).

**Clinical Presentation:**

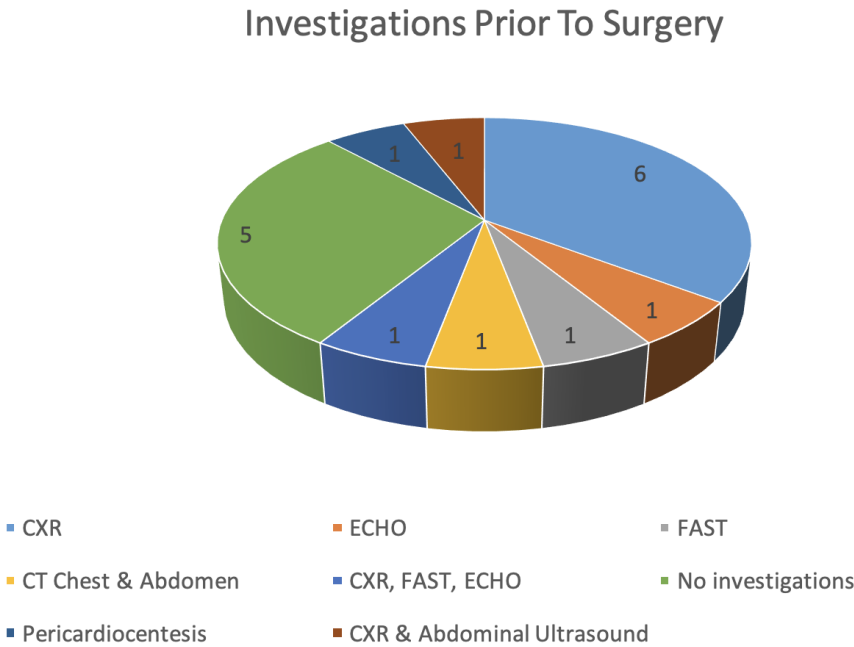
There were 11 patients with isolated thoracic wounds only to the left chest. The remaining patients had multiple or bilateral stab wounds. All patients in this study had at least one stab wound within the cardiac box.

There were three patients who did not have haemodynamic data recorded on presentation. Otherwise, most of the remaining patients showed signs of instability in the A&E department.

There were 11 haemodynamically unstable patients: 4 with un-recordable blood pressures and 7 with a systolic blood pressure (SBP) < 90mm Hg. In this group of 11 unstable patients, 6 (55%) had some form of investigation performed: plain chest radiographs in 3, pericardiocentesis in 1, echocardiogram in 1 and a combination of chest radiograph, focused assessment with sonography in trauma (FAST) plus echocardiogram in 1 patient.

There were 8 patients who were haemodynamically stable, with SBP >90mmHg. Two (25%) of these patients did not have any form of imaging. The remaining 6 patients had some form of imaging: plain chest radiographs only (3), plain chest radiograph with abdominal ultrasound (1), FAST alone (1) and CT scans of the chest and abdomen alone (1). The only investigations that contributed to the surgeons' decision to operate were CT scan and FAST. All the other stable patients had the decision for surgery based on clinical grounds, such as thoracostomy tube drainage volume or development of hypotension.

Overall 6 patients had a chest radiographs only, one had echocardiography only, one had FAST ultrasound, one had a CT chest and abdomen, one had a chest radiograph with abdominal ultrasound and one had a combination of chest radiograph, FAST and echocardiography in the A&E Department. There were no diagnostic pericardial windows performed (Figure 1).



**Figure 1.** A pie chart demonstrating the investigations performed prior to surgery.

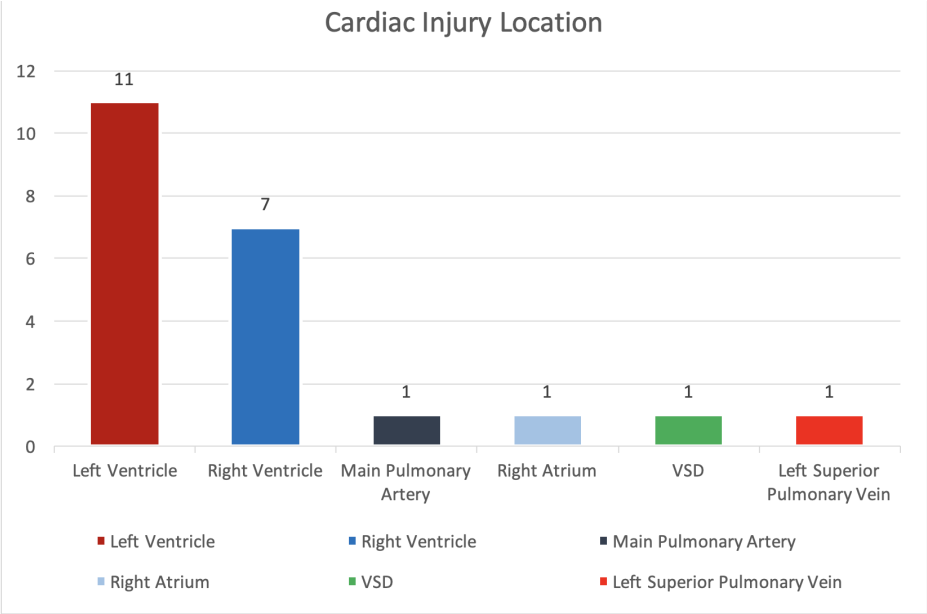
There were no timelines recorded in 5 patients. In the remaining 17 cases, the mean time spent in the A&E Department was 101 minutes (range 15 to 435 minutes). The mean interval between arrival at hospital and incision was 155 minutes (range 36 to 795 minutes). There was one patient who spent 435 minutes in the A&E Department and had an interval of 795 minutes between arrival and incision. Excluding this outlier, the mean time in the A&E Department was 80 minutes and the mean interval between arrival and incision was 114 minutes.

**Surgical Intervention:**

Twenty one (95.5%) patients in this study had emergency primary repair of their cardiac injuries. One patient had a delayed, elective repair of a traumatic ventricular septal defect. Only one patient required cardiopulmonary bypass in the emergency setting for repair of an injury to the left superior pulmonary vein.

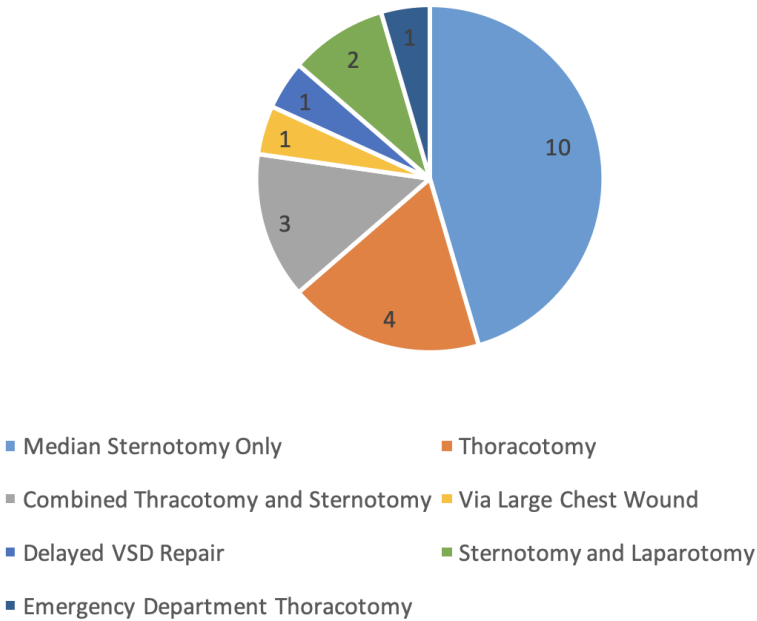
The ventricles were the most commonly injured cardiac structures (Figure 2).





**Figure 2.** Bar chart showing the anatomical distribution of the cardiac injuries

The most common surgical approach was a median sternotomy, as outlined in figure 3. In addition to their cardiac injuries, 7 patients had associated lung injuries, 1 had a diaphragmatic injury, 1 had a left internal mammary artery transection and 1 had intra-abdominal injuries. Two patients had laparotomies in addition to their thoracic surgery. One had a negative laparotomy and 1 had a serosal tear to the transverse colon that was repaired.



**Figure 3.** Surgical Procedures

**Therapeutic Outcomes:** There were 4 deaths recorded in this study, for an overall mortality of 17.4%. Three of the deaths were attributable to exsanguination and one to cardiac tamponade. Of these patients 3 had cardiac arrest prior to reaching the operating room and 2 had emergency department thoracotomies.

For the survivors, the mean length of hospital stay was 11 days (range: 4 to 56 days).

**DISCUSSION:** Patients with penetrating chest trauma who are haemodynamically unstable should be transported to the operating room for surgical exploration. Rapid diagnoses in stable patients with penetrating cardiac trauma are needed to ensure the best chance of survival. Our results show that the 155-minute interval between presentation and incision in this setting is too long.

Only 29% of the patients for whom data was available spent less than one hour in A&E Department, and none of those patients had any imaging performed. Two patients had investigations performed outside of the A&E Department. One patient had a CT showing a hemopericardium, but he was sent to the ward because his scan was not reviewed in a timely manner. The second patient had an echocardiogram in the recovery room after the decision to proceed with sternotomy had already been made.

Surprisingly, there were more left ventricular (LV) than right ventricular (RV) injuries in our case series. As the RV is the more anterior of the two chambers it would be expected to be more frequently injured, as found in the literature <sup>1,2</sup>. This may be due to the fact that there were a number of wounds laterally to the left chest in this series. Of the RV injuries, one was an iatrogenic injury during pericardiocentesis done in the A&E Department.

There were 4 deaths in this series and only 1 of these patients had spontaneous cardiac activity at the time of operation. The first death occurred in a patient who was intubated in A&E Department and had emergency department thoracotomy to repair a LV laceration. He was transported to the operating room, with a palpable carotid pulse, for sternotomy and formal closure of LV lacerations. However, he died four hours postoperatively from irreversible shock and disseminated intravascular coagulation.

The second death occurred in a patient who arrested during transport to the operating room. He had sternotomy and internal cardiac massage, but died on the table from a cardiac tamponade. The third fatality occurred in a patient who underwent sternotomy to repair an anterior LV laceration. The patient re-bled two hours post operatively and was taken back to the operating room in a pre-arrest state. The sternotomy was reopened and a missed inferior LV laceration was seen. The patient never regained a measurable blood pressure and died from exsanguination.

The fourth patient had a 6cm through-and-through laceration of the LV. He had a temporising repair of his LV in A&E and was transported to the operating theatre with internal cardiac massage. He never regained cardiac output and died on the table from exsanguination.

Of the 19 patients who reached the operating room with recordable vital signs, there was 1 death, yielding a mortality of 5.0%. In contrast, there was 100% mortality for patients who arrested prior to arrival in the operating room. The three patients without recordable vital signs were probably not salvageable, as this condition has a uniformly poor outcome <sup>3</sup>.

The overall mortality of 17% compares favourably with that of a recently published series of only penetrating cardiac stab wounds, which reported overall mortality of 60% <sup>1</sup>. The recommendation for EDT in penetrating trauma has changed, based on a 1% survival rate for patients undergoing EDT with no vital signs. Current recommendations reserve EDT in penetrating cardiac trauma to patients with refractory shock, and those undergoing CPR for less than 15 minutes <sup>3</sup>.

One limitation of this case series is the lack of a denominator, as we do not know how many patients with penetrating cardiac injuries died in the field or in the A&E Department without a diagnosis made. One early series suggests that only 6% of penetrating cardiac injuries make it to hospital alive, but this included gunshot wounds to the heart as well <sup>4</sup>. Additionally, we did not have complete clinical information for 5/22 patients, which in such a small study population may significantly affect the results.

The decision on the investigative pathways is difficult because echocardiography is not readily available by a trained echocardiographer in our setting. Currently, surgeon-directed echocardiography is used in stable patients with suspected penetrating cardiac injuries and the finding of intra-pericardial fluid mandates exploration. This approach has been shown to be effective in selecting out patients who need surgical intervention <sup>5</sup>.

The sub-xiphoid pericardial window as a diagnostic modality has been supplanted by FAST, which is highly sensitive and specific to detect penetrating cardiac injuries <sup>6</sup>. The subxiphoid window, however, is being proposed as a therapeutic strategy coupled with intra-pericardial lavage in stable patients with no evidence of ongoing bleeding at surgery <sup>7</sup>. In our setting it is rarely used, except in cases of thoraco-abdominal trauma where no intra-abdominal cause of bleeding or hypotension is found at laparotomy.

**CONCLUSION:** The majority of patients with cardiac stab wounds presenting to our institution are clinically unstable and require surgery on clinical grounds. The best outcomes are seen in patients who are operated on prior to cardiac arrest.

The use of surgeon-directed echocardiography in our setting has prevented negative procedures and has not resulted in any known fatalities from a missed cardiac injury.

Patients with cardiac stab wounds have variable survival, but this should not be interpreted to mean that a delay in making the diagnosis and operative treatment is acceptable, even in the stable patient. Too many patients are having imaging performed in the setting of an injury in the cardiac box with haemodynamic instability.

An institutional protocol is necessary in our institution to decrease the delay in treatment of these injuries.

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## ORIGINAL RESEARCH CONTRIBUTION

### Thoracic Empyema in Guyana: Analysis of the Factors Related to Therapeutic Outcomes

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## ABSTRACT:

**Objective:** This study sought to establish the risk factors, clinical features and demographics of patients who were diagnosed with complicated pleural empyema in a public tertiary center in Guyana. A secondary aim was to evaluate the therapeutic outcomes in these patients.

**Methods:** A retrospective observational study was performed over an 18-month study period from July 2015 to December 2016 at the Georgetown Public Hospital Corporation in Guyana. The records of all patients with complicated thoracic empyema were retrieved and the following data extracted: patient demographics, clinical features, microbiological characteristics, underlying risk factors, perioperative blood tests, therapeutic details and clinical outcomes. Univariate statistical analyses were performed on the data collected.

**Results:** There were 22 patients identified and they were predominantly male (81.8%), with a median age of 30 years. The majority of these patients developed community-acquired thoracic infections (85.7%) and there was a preponderance to affect the right chest (63.6%). A causative organism could be isolated in 19 (86.3%) patients. These included *Staphylococci Spp* (47.1%), *Klebsiella Spp* (23.5%), *Pseudomonas Spp* (17.6%), *Streptococci Spp* (11.7%) and *Mycobacteriae* (9.1%). Most of the patients (59%) were treated with open thoracotomy and decortication. In this setting, the overall morbidity rate was 36.4% and 30-day mortality rate was 9.1%. The factors that bore a statistically significant relationship to the development of complications were: co-existence of chronic diseases ( $p = 0.02$ ), delay in the consultation with thoracic surgery ( $p = 0.02$ ) and pleurotomy prior to surgery for  $>10$  days ( $p = 0.02$ ).

**Conclusions:** This study has identified the microbes commonly responsible for complicated thoracic empyema in this setting. In addition, we have shown that the therapeutic outcomes, morbidity and mortality are acceptable at this centre in Guyana.

**INTRODUCTION:** Thoracic empyema is a recognized complication of bacterial pneumonia. It continues to be a problem, despite recent advances in management<sup>1</sup>. This is evidenced by the high mortality rate associated with thoracic empyema, ranging from 6% to 24%<sup>2-5</sup>.

The recent literature demonstrates that an early and aggressive approach for thoracic empyema in phase II provides rapid relief from infection, leading to reduced morbidity, shorter hospital stay, lower cost and faster clinical resolution<sup>6</sup>. However, there seems to be a general tendency to persevere with antibiotics, thoracentesis, and closed intercostal tube drainage<sup>7-10</sup>. There also appears to be a general reluctance to refer patients with empyema early for operative management<sup>7-10</sup>.

This study sought to determine the common microbial causes of thoracic empyema in a developing country and identify drawbacks in the management of thoracic empyema in this tertiary referral hospital in Guyana.



**METHODS:** This study was reviewed and approved by the local institutional review board. We accessed the operating room registry at the Georgetown Public Hospital Corporation to identify all consecutive patients who underwent surgery for a thoracic empyema from July 1, 2015 to December 20, 2016. All patient records were retrieved and evaluated.

The following data were retrospectively extracted from patient records: patient demographics, associated risk factors, blood investigations, microbial cultures, electrocardiograms, plain chest radiograph findings, CT chest findings, chest ultrasound findings and results of diagnostic thoracocentesis. We also noted the duration of medical treatment prior to definitive surgery, interval between diagnosis and thoracic surgery consultations, duration of tube thoracostomy drainage prior to surgery, treatment modalities and the occurrence of complications. For the purpose of this study, we defined a consultation delay as a period >5days between admission and a request for thoracic surgery consultation.

All results were tabulated in an excel sheet and the statistical analyses were performed using SPSS version 16.0 software (SPSS Inc., Chicago, IL). Continuous data were expressed as mean and standard deviation and compared with Student's T-test. A P-value <0.05 was considered statistically significant.

**RESULTS:** Over the 18-month study period, there were 22 patients diagnosed with thoracic empyema in stage II-III. These patients had a mean age of 30 years (SD  $\pm$ 16.3) and 82% male preponderance (n =18). Four of these patients were children, ranging in age from 3 years to 9 years.

Overall, 10 (43.5%) patients had a recognized risk factor: asthma, diabetes mellitus, chronic obstructive pulmonary disease and drug or alcohol abuse. The commonest presenting symptoms were fever (90.9%), chest pain (41.1%) and dyspnea (40.9%).

The commonest cause of thoracic empyema was a complicated bacterial pneumonia in 17 (77.3%) patients - and most were community-acquired (85.7%). Other causes included retained haemothorax after chest trauma in 3 (13.6%) patients, previous thoracocentesis in 1 (4.5 %) patient and one retropharyngeal abscess (4.5 %) in a 3 year-old child.

A microbiological diagnosis was attained in 19 (86.3%) patients: Staphylococci Spp. (47.1%), Klebsiella Spp (23.5%), Pseudomonas Spp (17.6%), Streptococci Spp (11.7 %) and Mycobacteria (9.1%). The patients were treated with broad-spectrum antibiotics for a mean of 8.9 days (SD  $\pm$ 4.1) and all patients had thoracostomy tubes inserted. Fibrinolytics were not used in any patient in this series because they were unavailable in our resource-poor setting.

There was a consultation delay in 17 (77.3%) patients in this setting. At the time of referral to thoracic surgery, the patients had already been hospitalized for a mean of 8.86 days (SD  $\pm$  14.3) and had indwelling thoracostomy tubes for a mean of 7.7 days (SD  $\pm$  5.4). After the thoracic surgery team took over management, 5 (27.2%) patients required physiologic optimization to correct electrolyte imbalance and anemia for an additional 2-3 days before they were fit for surgical intervention.

All patients in this series underwent operative intervention: open thoracotomy with serratus preservation and decortication in 13 (59%) patients, open pulmonary resections in 3 (13.6%) patients, video-assisted (VATS) debridement with partial decortication in 3 (13.6%) patients, thoracostomy by Monaldi method in 2 (9.1%) patients and a modified Andrew's thoracoplasty with serratus muscle flap in 1 (4.5%) patient.

There were three patients who required open pulmonary resections. The first was a 10-year old boy with suppurative necrosis of lung parenchyma secondary to prolonged MRSA pneumonia, who eventually required a pneumonectomy. A superior left lobectomy was performed on a 9-year-old girl with lung abscess and empyema. A superior right lobectomy was performed in a 46-year-old man secondary to an infected ruptured bulla that communicated with the upper lobar bronchus.

In one patient, a muscle flap was performed with serratus and a modified Andrew's thoracoplasty. The thoracostomy by the Monaldi method guided by ultrasound was used in two patients who were in very poor general state and were both diagnosed with pulmonary abscesses and empyema.

The Claget window was used in two patients with active pulmonary Tuberculosis who developed an empyema after an unnecessary insertion of thoracic tubes.

After operation, the average duration of hospitalization was 8.8 days (SD  $\pm$  13.6) and 8 (34.8%) patients experienced at least one complication. The commonest post-operative complication was a prolonged air leak for >7 days in 3 (13.6%) patients. In all cases, the prolonged air leak was managed expectantly with suction and chest physiotherapy. In one case, a second thoracostomy tube was required. The other complications in this series included sepsis in 2 (9.1%) patients, electrolyte disturbances in 1 (4.5%) patient, persistent arrhythmiae in 1 (4.5%) patient and thrombophlebitis in 1 (4.5%) patient.

In this series there were 2 (9.1%) deaths recorded. The first patient was a ten year-old boy with cerebral palsy in whom a pneumonectomy was performed to treat multiple lung abscesses, areas of necrosis and inability to obtain adequate re-expansion. He eventually succumbed to sepsis with Methicillin Resistant Staphylococcus Aureus (MRSA). The second death was recorded in a 55 year-old, undernourished man with poorly controlled diabetes mellitus. He has a persistent empyema after decortication and eventually required an Eloesser window. He eventually succumbed 25 days postoperatively due to MRSA sepsis.

Yates correction for Chi square was used to evaluate post-operative morbidity. There was a significantly greater incidence of complications in patients with comorbidities present (50% vs 25%;  $p = 0.02$ ), consultation delays (63% vs 38%;  $p = 0.02$ ) and those who had pleurotomy prior to surgery for >10 days (75% vs 25%  $p = 0.01$ ). We did not find any factor that had a statistically significant relationship with mortality.

**DISCUSSION:** In this study population, 44% of patients who developed a thoracic empyema had a predisposing condition present that led to immunosuppression or predisposed to micro-bronchial aspirations. These findings are generally in keeping with the existing medical literature, where two thirds of the patients present with predisposing conditions <sup>5</sup>.

Most patients in our study population developed thoracic empyema as a consequence of complicated bacterial pneumoniae and retained haemothoraces after trauma. Again, this is in keeping with existing data in the medical literature <sup>12</sup>. Similarly, the microbial flora was similar to that seen in developing countries <sup>11</sup>.

It is important to make an early diagnosis in order to institute operative treatment that aims to evacuate infected material, release lung tissue and adequately occlude any residual spaces. However, in this study there was often a diagnostic delay in 77% of patients. This was likely due to a low index of suspicion by attending medical personnel and would have a negative impact on therapeutic outcomes. This may be solved by implementation of educational campaigns to increase disease awareness and also attention by policy makers to streamline referral processes.

In the subgroup of patients in whom the diagnosis of thoracic empyema was made, there was a delay in establishing aggressive treatment because physicians had a tendency to persevere with antibiotics and thoracostomy tubes. A possible contributing factor was that a thoracic surgery service was not present in this setting for over two decades. Therefore, the established norm was for these patients to be managed conservatively by internal medicine and/or general surgery teams, without established protocols or risk-stratification. This situation may have contributed to delays in referral to the thoracic surgery units and/or less aggressive management. A delay in referral to the thoracic surgery service was recognized as an independent risk factor for the development of complications. This delay in referral to thoracic surgeons is also a problem in developed countries <sup>12</sup>, due to a variety of factors such as: misinterpretation of imaging, lack of therapeutic protocols and inadequate referral pathways. Similar causes may have been responsible for the delay in our setting.

Despite these management drawbacks, the overall morbidity and mortality rates in this series were comparable to large volume centres <sup>13</sup>. This may be due to the fact that there were no patients with empyemas secondary to malignancy or pulmonary resective surgery, which usually have a more torrid evolution and worse prognosis <sup>14</sup>.

**CONCLUSIONS:** In this setting, the causes and microbial profile of thoracic empyemas are similar to developed nations. However, there is an unacceptably high rate of referral delays in this setting that may have contributed to greater morbidity and mortality. This should be addressed by educational campaigns to increase physician awareness, development of local therapeutic protocols suited to the local healthcare environment and streamlined referral processes in the local setting.



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